2006 Building Code Overview Training Courses

Complex Buildings 2006

Participant/Self-Study Manual

This course material may assist you in preparing for writing the Ministry exams however it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

Building and Development Branch
Ministry of Municipal Affairs & Housing

Ontario

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Ministry of Municipal Affairs and Housing

COMPLEX BUILDINGS - 2006

PARTICIPANT MANUAL

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This course was developed and produced by:

Leber|Rubes Incorporated

for the:

Ministry of Municipal Affairs and Housing

This course is based on the Building Code Act, S.O. 1992, C.23 as amended to June 22, 2006 and the Ontario Building Code 2006 (O.Reg. 350/06) as amended (O.Reg. 205/08 to December 21, 2009 (O. Reg. 503/09)).

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Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 1

COMPLEX BUILDINGS - 2006

INTRODUCTION AND INSTRUCTIONS

ADMINISTRATIVE REQUIREMENTS

COURSE OBJECTIVES

The objective of this course is to help you understand the requirements of the Building Code applicable to complex buildings.

Complex Buildings include:

(a) Post-disaster buildings, and

(b) buildings containing building systems, works, fixtures and service systems to which Division B, Subsection 3.2.6. or provision in Articles 3.2.8.3 to 3.2.8.11. apply [Table 3.5.2.1., Div. C. Sentence 3.5.2.1.(1)].

While the Ministry of Municipal Affairs exam syllabus for complex buildings includes requirements contained in Division A, Parts 1, 2 and 3; Division B, Parts 1, 3, 4, 5, 6, 7, 9, 11 and 12; Division C, Parts 1 and 2; and Supplementary Standards SA-1, SB-1, SB-2, SB-4, SB-8 and SB-10, this course assumes that the participant has a basic understanding of all requirements applicable to 'Large Buildings' as described in the Ministry training course. This course will reinforce some of the requirements applicable to large buildings to give the participant a better understanding of the requirements pertaining to 'Complex Buildings'.

Questions on the Ministry's exams are all multiple choice. They have been chosen to address Code requirements based on the "Difficulty", "Importance" and "Frequency" of the requirement. Each question attempts to test the ability of the candidate to **FIND, UNDERSTAND** or **APPLY** the Code requirements.

Difficulty:	How hard it is to understand, interpret and apply the underlying intent of the provision?
Importance:	How important is the Article in supporting the purpose or objectives of the Code (health, safety, fire protection, structural sufficiency, accessibility, conservation and environmental integrity of the building)?
Frequency:	How often the provision is applied?

The examination questions focus on areas of high relevance (difficulty, importance and frequency) and are geared to assess a candidate's ability to find, understand and apply these provisions.

Find:	Search the Code and find or identify a Code provision.
Understand:	Comprehend the language, structure and intent behind a Code provision(s).
Apply:	Use the Code provision(s) in a case example, situation, or scenario.

Taking this course will not qualify you for 'Advanced Standing'. Refer to the Ministry website above for details.

LEARNING OUTCOMES

The course has been designed to increase a practitioner's knowledge of the Code and to hone skills in terms of their ability to **FIND** (search the Code and identify Code provisions), **UNDERSTAND** (to comprehend the language, structure and intent of a Code provision), and **APPLY** the Code provision(s) using case examples, situations and scenarios.

The Ministry of Municipal Affairs also provides more comprehensive courses for practitioners wishing to obtain more detailed training in the use and application of the Code and a number of its referenced standards.

For information on the available courses, refer to the following website:

http://www.ontario.ca/buildingcode

under the heading "Training".

COURSE FORMAT

This course is organized in fifteen modules and is intended for those who desire to become more proficient in applying the provisions of the requirements applicable to Complex Buildings.

PURPOSE OF THE EXERCISES

Every module contains a number of exercises. Each exercise is designed to help you to identify, understand and apply the requirements of the Code and their effect on the design and construction of complex buildings. The exercises are fill-in-the-blanks. You will also be asked to complete charts and tables which can later be used as reference material.

You will also be required to indicate the Code reference for your answer. Pay attention to the detail of the reference. Any time a Code reference is asked for, it will be identified by brackets [. . .]. For the most part Code references apply to

Division B requirements, unless otherwise indicated.

As you go along, you are encouraged to modify and enhance your copy of the Code.

When reference is made to specific parts of the Building Code at the beginning of an exercise, you may find it useful to review those references before attempting the exercise.

COURSE RESOURCES

Your participation, with support from the Facilitator, the Code, and the experiences, ideas, and comments of your fellow participants are the primary resources of this course. The objective of the course integrates your education, prior training and on-the-job experience, as well as those of your peers. It is important that you participate. For each question or task that is assigned to your table-group, you will select a spokesperson who will print the agreed upon answer on the flipchart. When asked by the Facilitator, the spokesperson will explain the group's answer, which forms the basis for class discussion.

The course only requires the latest edition of the following documents:

1. 2006 Building Code Compendium, Volume 1 and Volume 2

The above documents are available for purchase through:

Downtown ServiceOntario
777 Bay St., Market Level
Toronto, ON M5G 2C8

Tel: 1-800-668-9938, 416-326-5300
Fax: 613-545-4223

https://www.publications.serviceontario.ca

Government Service
110 Laurier Ave. West
Ottawa, ON K1P 1J1
Tel. 1-800-268-7095

COURSE OVERVIEW

As stated earlier, the course is organized into fifteen modules. The modules are described as follows:

Module 1	Introduction and Instructions, Administrative Requirements (Div. A, Div. B, Part 1, Div. C, SA-1)
Module 2	General Fire Protection, Occupancy, Noncombustibile Construction, Fire-Resistance, Flame-Spread, Smoke Developed Classifications (Section 3.1.)
Module 3	Supplementary Standard SB-2 - Fire Performance Ratings
Module 4	Building Fire Safety (Section 3.2. - some exceptions)
Module 5	Provisions for Firefighting (Subsections 3.2.5., 3.2.9.)
Module 6	Renovations (Compliance Alternatives, Section 11.5)
Module 7	Environmental Separation – Part 5/Anchorage for Fixed Access Ladders SB-8/Sections 3.9. through 3.16.
Module 8	Additional Requirements for High Buildings (Subsection 3.2.6.)
Module 9	Supplementary Standard SB-4 - Measures for Fire Safety in High Buildings
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Appendix A	Additional Study Materials

A GUIDE TO THE USE OF THE BUILDING CODE

The Building Code is a regulation made under the Building Code Act. This edition is prepared for purposes of convenience only and contains additional explanatory material. For accurate reference, recourse should be had to the Official Volumes.

The Building Code is based, in large measure, on the Model National Building Code of Canada (NBC).

The Code is essentially a set of minimum provisions respecting the safety of buildings with reference to public health, fire protection and structural sufficiency. It is not intended to be a textbook on building design, advice on which should be sought from professional sources. Its primary purpose is the promotion of public safety through the application of appropriate uniform building standards.

The 2006 edition of the Building Code is the first to be published in an objective-based format. The Building Code is divided into three divisions which are further subdivided into parts: Division A, Compliance, Objectives and Functional Statements; Division B, Acceptable Solutions; Division C, Administrative Provisions. In addition, the Code provides two sets of Appendices; Appendix A contains explanatory information to assist Code users in understanding the intent of requirements contained in Divisions A, B and C. Appendix B contains Imperial conversion factors for metric values used in the Code and lastly, Supplementary Standards which supersede former Supplementary Guidelines referenced in the 1997 edition of the Code. Supplementary Standards with the SA prefix are referenced in Division A, Supplementary Standards with the SB prefix are referenced in Division B, and Supplementary Standards with the SC prefix are referenced in Division C.

DIVISION A, PART 1 – COMPLIANCE/GENERAL SECTION 1.1 ORGANIZATION AND APPLICATION

The "Organization and Application" of the Code is located in Division A, Part 1, Section 1.1. This section provides a description of the scopes of each of the divisions of the Code and statements regarding the applications of the various parts of Division B. Division B contains all of the acceptable solutions for compliance with requirements of the Code. Division B is broken down into 12 parts, including a Part on resource conservation.

Division B is divided into 12 Parts and a decimal numbering system has been used to identify particular requirements. The first number indicates the Part of the Code, the second, the Section in the Part, the third, the Subsection and the fourth, the Article in the Subsection. An Article may be further broken down into Sentences (indicated by numbers in brackets), and the Sentence further divided into Clauses and Subclauses. These are illustrated as follows:

3	Part
3.4.	Section
3.4.6.	Subsection
3.4.6.5.	Article
3.4.6.5.(1)	Sentence
3.4.6.5.(1)(c)	Clause
3.4.6.5.(1)(c)(i)	Subclause

SECTION 1.2, COMPLIANCE

Compliance with Division B of the Code may now be achieved by:

a) complying with the applicable, acceptable solutions in Division B, **OR**
b) by using alternative solutions that will achieve the level of performance required by the applicable, acceptable solutions in respect to the objectives and functional statements attributed to the applicable, acceptable solutions in Supplementary Standard SA-1for the purpose of determining using an alternative solution. The level of performance in respect to the functional statement refers to the performance of the functional statement as it relates to the objective with which it is associated in SA-1.

SECTION 1.3, INTERPRETATION

Section 1.3 contains interpretation requirements related to designated structures and farm buildings.

SECTION 1.4, TERMS AND ABBREVIATIONS

Section 1.4, "Terms and Abbreviations" are described in the following section of Module 1 entitled "Basic Rules from the Code".

SECTION 1.5, REFERENCED DOCUMENTS AND ORGANIZATIONS

Provisions of referenced documents in Divisions A and B apply only to:

a) buildings, and
b) objectives and functional statements attributed to the acceptable solutions in Division B [Div. A., Sentence 1.5.1.1.(1)].

Document editions and abbreviations are found in Division B, Section 1.3 [Div. A., Sentence 1.5.1.3.(1)].

BASIC RULES FROM THE CODE

DEFINED WORDS, TERMS AND PHRASES

Words, terms and phrases with special meaning are defined in Division A, Part 1, Sentence 1.4.1.2.(1) of the Code.

The definition always applies unless the word, term or phrase has a special purpose definition listed elsewhere.

For consistency with the Code, defined terms are shown in *italics*. The definition for each defined term used in a module is repeated at the beginning of each module.

NON-DEFINED WORDS, TERMS AND PHRASES

Consult Division A, Part 1, Sentence 1.4.1.1.(1) of the Code. It provides direction for dealing with non-defined terms. Note any question, comment or concern in the space provided.

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ABBREVIATIONS AND SYMBOLS

The Code makes use of symbols and abbreviated nouns, terms and proper names. For example, Clause 3.2.6.5.(3)(a) makes reference to CAN4 and Clause 3.2.6.5.(6)(b) to ULC, both being abbreviated names of Underwriters' Laboratories of Canada. Division B, Part 1, Article 1.3.2.1. will reveal a number of abbreviations for proper names, along with contact information.

The meanings assigned to other 'Symbols and Abbreviations' used in the Code are found in Division A, Part 1, Sentence 1.4.2.1.(1). As examples, the letter 'h' means 'hour' in Clause 3.2.2.23.(2)(c) and 'hours' in Clause 3.2.2.23.(2)(b); the expression '1 in 2' means a slope of 1 vertical unit to 2 horizontal units.

BASIC RULES FOR READING THE CODE - SCOPE AND APPLICATION OF CODE REQUIREMENTS

Individual requirements within the Code do not apply to every building. Guidance in the application of each of the 12 Parts of Division B to a particular building is found in Division A, Part 1, Subsection 1.1.2., "Application of Division B".

For instance, Division A, Part 1, Sentence 1.1.2.1.(1) informs us that Parts 1, 7 and 12 apply to every building. On the other hand, Division A, Part 1, Sentence 1.1.2.4.(1) reveals that Part 9 would apply to buildings of residential, business, low and medium hazard industrial, and mercantile occupancies of three storeys or less in building height and having a building area not exceeding 600 m^2.

In another instance, Division A, Part 1, Subclauses 1.1.2.2.(1)(b)(i) to (iv) indicate that a building of residential, business, low and medium hazard industrial or mercantile occupancy would be governed by Part 3, instead of Part 9, if the building area exceeded 600 m^2 or the building height exceeded 3 storeys.

It becomes very clear that one does not jump from Part 9 to Part 3, or from Part 3 to Part 9, unless the Code provides direction to that effect. Consider Division B, Articles 3.1.7.1. and 9.10.3.1. as one example and Articles 3.1.8.10. and 9.10.13.2. as a second example.

In the first instance, Division B, Sentence 9.10.3.1.(1) informs us that a fire-resistance rating can be determined in conformance with the test methods described in Part 3, thus in this instance, the requirements of Article 3.1.7.1. may be applied to a building regulated by Part 9.

In the second instance, Sentence 3.1.8.10.(4) informs us that in schools a door assembly conforming to Articles 9.10.13.2. and 9.10.13.3. is permitted as a closure in a fire separation having a fire-resistance rating of 30 minutes. Thus in this instance, a provision of Part 9 is deemed to form part of a Part 3 requirement.

DEALING WITH 'AND'

The word **'and'** found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirements of **every** Clause apply to the Sentence.

Example:

In Division B, Sentence 3.2.8.7.(2) reads:

In a building containing an interconnected floor space

a) waterflow alarm signals from sprinkler systems shall be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4), and
b) sprinkler systems shall be electrically supervised as required in Sentence 3.2.4.9.(2).

Sentence 3.2.8.7.(2) informs us that in a building containing an interconnected floor space, the sprinkler systems shall have two things:

1. water flow alarm signals shall be transmitted to the fire department, AND
2. be electrically supervised.

DEALING WITH 'OR'

The word **'or'** found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirement of the Sentence is satisfied by any Clause as applied individually.

Example:

In Division B, Sentence 3.2.9.4.(7) reads:

A hose is permitted to penetrate an exit in order to provide the required coverage to
a) a service room referred to in Sentence 3.2.9.1.(4),
b) a roof-top enclosure referred to in Sentence 3.2.9.1.(5),
c) a room not more than 50 m^2 in area, or

d) a room or group of rooms in a sprinklered floor area not more than 200 m^2. Sentence 3.2.9.4.(7) informs us that a fire hose is permitted to penetrate an exit in order to provide the required coverage to any one of four areas:

1. a service room, **OR**
2. a rooftop enclosure, **OR**
3. a room less than 50 m^2 in area, **OR**
4. a sprinklered room or group of rooms less than 200 m^2 in area.

DEALING WITH 'AND'/ 'OR'

Example:

Division B, Sentence 3.2.6.1(1) reads:

This Subsection applies to a building

a) of Group A, D, E or F major occupancy classification that is more than

    i) 36 m high, measured between grade and the floor level of the top storey, or
    ii) 18 m high, measured between grade and the floor level of the top storey, and in which the cumulative or total occupant load on or above any storey above grade, other than the first storey, divided by 1.8 times the width in metres of all exit stairs at that storey, exceeds 300,

b) containing a Group B major occupancy in which the floor level of the highest storey of that major occupancy is more than 18 m above grade,

c) containing a floor area or part of a floor area located above the third storey designed or intended as a Group B, Division 2 or 3 occupancy, and

d) containing a Group C major occupancy whose floor level is more than 18 m above grade.

3.2.6.1.(1) informs us that the additional requirements for High Buildings found in 3.2.6. apply to:

1. Group A, D, E or F classified buildings (major occupancy) more than 36 m high, **OR**

   Group A, D, E, or F classified buildings (major occupancy) more than 18 m high if the total occupant load above the first storey , divided by 1.8 times the width of all exit stairs at the storey above the first, exceeds 300, **AND**

2. Buildings containing a Group B major occupancy more than 18 m high, **AND**

3. Buildings containing a floor area or part of a floor area above the third storey intended as a Group B, Division 2 OR 3 occupancy, **AND**

4. Buildings containing a Group C major occupancy whose floor level is more than 18 m above grade.

RULES OF THE CODE

The Code is structured into a number of Rules that apply without exception. For example, Division B, Sentence 9.1.1.3.(1) tells us that self-service storage buildings (even those with a building area of less than 600 m^2) are regulated by Section 3.10.

GENERAL RULES OF THE CODE AND EXCEPTIONS

At other times, the user of the Code has to consider a general rule and exceptions as they apply. Consider the requirements for automatic sprinkler systems in Division B, Sentence 3.2.5.13.(1):

> Except as provided in Sentences (2) to (4), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems".

The general rule of Sentence 3.2.5.13.(1) informs us that sprinkler systems are to be designed, constructed, installed and tested in conformance with NFPA 13.

OR

There are three exceptions to the general rule of Sentence 3.2.5.13.(1). The first exception in Sentence 3.2.5.13.(2) states:

> Instead of requirements of Sentence (1), NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Storeys in Height", is permitted to be used for the design, construction, installation and testing of an automatic sprinkler system installed in a building of residential occupancy that is not more than 4 storeys in building height or a Group B, Division 3 occupancy that contains sleeping accommodation for not more than 10 persons, and not more than 6 persons that required assistance in case of emergency.

The second exception in Sentence 3.2.5.13.(3) states:

> Instead of the requirements of Sentence (1), NFPA 13D, "Installation of Sprinkler Systems in One-and Two-Family Dwellings and Mobile Homes", is permitted to be used for the design, construction, installation and testing of an automatic sprinkler system installed in a building of residential occupancy that contains not more than 2 dwelling units.

The third exception in Sentence 3.2.5.13.(4) states:

> If a building contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the building provided the required flow for the sprinklers can be met by the domestic system.

VERY IMPORTANT

When the Code spells out a general rule and exceptions thereto, conformity with the Code is obtained by complying with EITHER the general rule OR the exception thereto.

TABLES, TEXT AND FOOTNOTES

Whenever you are called upon to use a Table in the Code, you have to **consider the text** associated with **the Table** AND **the footnotes**. For example, Division B, Table 3.1.3.1 forms part of Sentence 3.1.3.1.(1). One of the Notes to Table 3.1.3.1., Note (2) directs us to Sentence 3.1.3.2.(1), which tells us that any building with any Group A, B or C occupancy, cannot contain a major occupancy of Group F, Division 1.

SUPPLEMENTARY GUIDELINES AND REFERENCED DOCUMENTS

By virtue of Paragraph 34.-(1) 9 of the Building Code Act, the "Supplementary Standards to the 2006 Ontario Building Code", SA-1, SB-1 to SB-11 and SC-1, and the Referenced Documents listed in Division B, Part 1, Section 1.3 of the Code, form an integral part of the Building Code.

APPENDICES AND ILLUSTRATED GUIDES

On the other hand, Appendix A "Explanatory Material for Division B", Appendix B "Imperial Conversions of Metric Values" have been prepared for convenience only, and as such, are explanations that do not form part of the Building Code and are not intended to limit the ways by which compliance with OBC requirements can be achieved.

DIVISION A, PART 2 - OBJECTIVES

Objectives for all the requirements in the Code are broken down into the following categories and subcategories. Category "Safety" identified by the prefix OS, "Fire Safety" identified by the prefix OS1, "Structural Safety" identified by the prefix OS2, "Safety in Use" identified by the prefix OS3 and "Resistance to Unwanted Entry" identified by the prefix OS4. "Health Objectives" is identified by the prefix OH, with the following sub-prefixes "Indoor Conditions" – OH1, "Sanitation" – OH2, "Noise Protection" – OH3, "Vibration and Deflection Limitation" – OH4, "Hazardous Substances Containment" – OH5, "Privacy" – OH6, and "View to the Outdoors" – OH7. Accessibility category OA is further subdivided into the following subcategories: "Barrier-free Path of Travel" – OA1, "Barrier-free Facilities" – OA2, "Fire Structural Water and Sewage Protection of Buildings" is identified by the prefix OP with subcategories: "Fire Protection of the Building" – OP1, "Structural Sufficiency of the Building" – OP2, "Protection of Adjacent Buildings from Fire" – OP3, "Protection of Adjacent Buildings from Structural Damage" – OP4, "Water and Sewage Protection of Buildings and Facilities" – OP5. "Resource Conservation Objective" is identified by the prefix OR with subcategories: "Water Conservation" – OR1, and "Energy Conservation" – OR2. "Environmental Integrity" is identified by the prefix OE. "Conservation of Buildings" is identified by the prefix OC.

DIVISION A, PART 3 - FUNCTIONAL STATEMENTS

The list of functional statements applies only to the extent that they relate to compliance with the Code as described in Division A, Section 1.2, Compliance. Functional statements are a list of 140 statements which describe the intent of the Code requirements described in Division B as they relate to one or more of the objective statements previously identified.

OBJECTIVES AND FUNCTIONAL STATEMENTS ATTRIBUTED TO THE ACCEPTABLE SOLUTIONS IN DIVISION B

For the purposes of complying with the Code, as required by Division A, Sentence 1.2.1.1.(2), the objectives and functional statements attributed to the acceptable solutions in Division B are listed in Tables 3 to 12 of Supplementary Standard SA-1.

Table 3 relates to Division B, Part 3 requirements; Table 4 relates to Division B, Part 4 requirements, etc.

ADMINISTRATIVE DIVISIONS

DIVISION C, PART 1

Section 1.1 Administration, Article 1.1.1.1. indicates that the Code shall be administered in conformance with the Building Code Act. Section 1.2 Design and General Review. Section 1.3 Permits and Inspections, describes the requirements for permits. Sentence 1.3.1.1.(1) Requirements for Permits, Sentence 1.3.1.4.(1) Permits under Section 10 of the Act and Sentence 1.3.1.5.(1) Conditional Permits. Subsection 1.3.3., Occupancy of Unfinished Buildings, should be reviewed by Complex Building course participants, as well as Subsection 1.3.5., Notices and Inspections.

The participants should be familiar with all of Part 1.

DIVISION C, PART 2
ALTERNATIVE SOLUTIONS, DISPUTES, RULINGS AND INTERPRETATIONS

Section 2.1 entitled "Alternative Solutions" indicates in Subsection 2.1.1., the documentation for alternative solutions required to be provided to the chief building official or registered code agency. The documentation provided must identify the applicable objectives, functional statements and acceptable solutions and establish on the basis of either past performance, tests or other evaluations, that the proposed alternative solution will achieve the level of performance required under Article 1.2.1.1. of Division A, which is the compliance Article for compliance with Division B previously described. The documentation required for an alternative solution must include information about relative assumptions, limiting or restricting factors, testing procedures, studies or building performance parameters, including any commissioning, operational and maintenance requirements.

According to Article 2.1.1.2. "Tests", where no published test or method to establish the suitability of an alternative solution exists, then tests used for the purposes of Article 2.1.1.1. shall be designed to simulate or exceed anticipated service conditions, or shall be designed to compare the performance of material or system with a similar material or system that is known to be acceptable. Results of tests evaluations based on test standards other than described in the Code may be used for the purposes of Sentence (1) of Article 2.1.1.2. if the alternate test standards provide comparable results. As an example, a test conducted in accordance with the Standard ASTM E119 for determining fire-resistance ratings may be used as a comparable test standard to that described in the Code; ULC-S101, "Fire Endurance Tests of Building Construction and Materials", as referenced in Division B, Article 3.1.7.1., Sentence (1), for most types of building materials and assemblies.

In Appendix A of the Complex Building course is an example of an alternative solution submission including the documentation typically provided as described in Article 2.1.1.1.

DIVISION C, PART 2, SECTION 2.4 – RULINGS AND INTERPRETATIONS

The following subsections are required to be understood by Complex Building course participants, Subsection 2.4.1. Designated Materials Evaluation Bodies, Article 2.4.2.1. Ministers Rulings and Subsection 2.4.3. Interpretations by the Minster of Housing under Section 28.1 of the Building Code Act.

EXERCISE #1-1

1. Provide the objectives and functional statements attributed to the following (acronyms only required):

   a) 3.3.1.20.(1)
   ______________[______________]

   b) 3.8.3.3.(3)
   ______________[______________]

   c) 4.1.5.15.(3)
   ______________[______________]

   d) 6.3.1.2.(2)
   ______________[______________]

2. What is objective OS1.3? What category?

   ________________________[______________]

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3. What is functional statement F12?

______________________ [____________]

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STOP

CLOSING COMMENTS

During the delivery of the course, you are asked to obey the STOP signs; the Facilitator will provide guidance to keep the course moving. Bring your questions and comments to the course and participate in all the discussions.

Your evaluation of the course and comments on its contents will be collected during the final session. Your input is important; it enables the Building and Development Branch of the Ministry of Municipal Affairs to keep the course current and to meet your needs. In preparation, you are asked to note your comments on plain paper as we proceed through the training modules. They will be collected at the end of the course. You will also be asked to evaluate the Facilitator and the facilities where the course is being held, at the end of the course.

Unlike the course for the qualification examination, you will be asked to provide references to support your answers. Nevertheless, you are strongly encouraged to find the supporting part of the Code. Remember, you need to find a requirement before you can understand and apply it.

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 2

COMPLEX BUILDINGS - 2006

OCCUPANCY, NONCOMBUSTIBLE CONSTRUCTION, FIRE-RESISTANCE, FLAME-SPREAD, SMOKE DEVELOPED CLASSIFICATIONS

2.1 INTRODUCTION

Some requirements of the Building Code are dependent on the 'major occupancy' of that building. 'Occupancy' is defined in Division A, Article 1.4.1.2. as ". . . the use or intended use of a building or part thereof for the shelter or support of persons, animals or property."

The word 'occupancy' should not be confused with the term 'major occupancy' which is defined as " . . . the principal occupancy for which a building or part thereof is used or intended to be used, and shall be deemed to include the subsidiary occupancies which are an integral part of the principal occupancy".

In this module we will examine the provisions of the Code that apply to the classification of buildings and requirements pertaining to the separation of major occupancies. We will identify permitted combustible materials in buildings required to be of noncombustible construction. We will study 'fire protection ratings' of closures and surface burning characteristics of building materials.

Objectives

- Provide an understanding of the different major occupancies outlined in the Code by the alphanumerical method.
- Identify the required fire-resistance rating for fire separations between major occupancies.
- Identify the types of combustible materials that can be used in a building required to be of noncombustible construction.

- Understand and apply the provisions of the Code relating to closures and components of closures.
- To provide an understanding of the requirements of the Code relating to flame-spread ratings and smoke developed classifications of materials.
- Reference applicable standards.

2.2 OVERVIEW (Section 3.1)

Review definitions on your own time.

Definitions

The definitions below relate to the content in this module and are from Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in *italics* text. Defined terms will not be shown in italics in this module, other than in this section.

Building area
Building area means the greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.

Closure
Closure means a device or assembly for closing an opening through a fire separation or an exterior wall, such as a door, a shutter, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

Combustible
Combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Noncombustibility in Building Materials".

Combustible construction
Combustible construction means that type of construction that does not meet the requirements for noncombustible construction.

Fire compartment
Fire compartment means an enclosed space in a building that is separated from all other parts of the building by enclosing construction that provides a fire separation that may be required to have a fire-resistance rating.

Fire damper

Fire damper means a closure which consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly, and designed to close automatically in the event of a fire in order to maintain the integrity of the fire separation.

Fire protection rating

Fire protection rating means the time in minutes or hours that a closure will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this Code.

Fire-resistance rating

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria or as determined by extension or interpretation of information derived from that test as prescribed in this Code.

Fire separation

Fire separation means a construction assembly that acts as a barrier against the spread of fire (see also Appendix A).

Firewall

Firewall means a type of fire separation of noncombustible construction which subdivides a building or separates adjoining buildings to resist the spread of fire and that has a fire-resistance rating as prescribed in this Code and the structural stability to remain intact under fire conditions for the required fire-rated time.

Flame-spread rating

Flame-spread rating means an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test as prescribed in this Code.

Floor area

Floor area means the space on any storey of a building between exterior walls and required firewalls including the space occupied by interior walls and partitions, but not including exits, vertical service spaces, and their enclosing assemblies.

Major occupancy

Major occupancy means the principal occupancy for which a building or part of a building is used or intended to be used and is deemed to include the subsidiary occupancies that are an integral part of the principal occupancy.

Noncombustible

Noncombustible means that a material meets the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Non-combustibility in Building Materials".

Noncombustible construction

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.

Occupancy

Occupancy means the use or intended use of a building or part of a building for the shelter or support of persons, animals or property.

Partition

Partition means an interior wall, one storey, or part storey in height that is not loadbearing.

BUILDING CLASSIFICATION (3.1.2.)

The following definitions are taken from Division A, Article 1.4.1.2. of the Code, for the following occupancies:

Assembly

Assembly occupancy (A1, A2, A3 and A4): the occupancy or use of a building or part of a building by a gathering of persons for civic, political, travel, religious, social, education, recreational or similar purposes or for the consumption of food or drink.

Care or detention

Care or detention occupancy (B1, B2 and B3): the occupancy or use of a building or part of a building by persons who:

a) are dependent on others to release security devices to permit egress,
b) receive special care and treatment, or
c) receive supervisory care.

Residential

Residential occupancy (C): the occupancy or use of a building or part of a building by persons for whom sleeping accommodation is provided but who are not harboured or detained there to receive medical care or treatment, or who are not involuntarily detained there.

Business and personal service

Business and personal service occupancy (D): the occupancy or use of a building or part of a building for the transaction of business or the provision of professional or personal services.

Mercantile

Mercantile occupancy (E): the occupancy or use of a building or part of a building for the displaying or selling of retail goods, wares or merchandise.

Industrial

Industrial occupancy (F1, F2 and F3): the occupancy or use of a building or part of a building for the assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials.

Table 3.1.2.1 shows that some groups are broken down into divisions, for a more precise description of major occupancies.

You may have noticed, from the definition provided in the introduction to this module, that having a 'major occupancy' does not prevent subsidiary occupancies in the building.

The dividing line between a major occupancy and a subsidiary occupancy is not always clear-cut. Judgement and a clear understanding of concepts and terminology must be used to arrive at the appropriate classification.

A school would be classified as a Group A, Division 2 major occupancy. In addition to classrooms, the building could contain offices, laboratories, gymnasia and workshops that could be considered subsidiary occupancies. Nevertheless, the major occupancy of the building would be Group A, Division 2. This classification would apply wherever the requirements for major occupancy were specified.

Effect of Appendices

Table 3.1.2.1 provides a description of major occupancies, but no examples are listed. While there are examples provided in Appendix A, the appendices are not part of the Code; they merely contain explanatory information to assist Code users in understanding the text of the Code.

SEPARATION OF MAJOR OCCUPANCIES: FIRE SEPARATIONS (3.1.3.1.)

Many buildings contain combinations of major occupancies that may represent a hazard to one another due to increased risk of exposure to fire. As a result, the Code requires that certain major occupancies be isolated from one another by fire separations, to protect one from the danger created by the other.

Based on the combination of major occupancies in a building, the designer must determine that appropriate fire separations are provided between adjoining major occupancies. Such fire separations are required to protect one major occupancy from another as they represent a hazard to each other. This provides time to evacuate one major occupancy in case of fire in an adjoining one. Adjoining means above, below or beside one another. Therefore, the plane of the fire separation could be either vertical or horizontal.

The required fire-resistance rating of a fire separation between adjoining major occupancies is determined from Table 3.1.3.1.

As we progress through this course, you will realize that the Code requires fire separations at numerous locations throughout a building. Fire separations are intended to slow or prevent the spread of fire and its smoke from where it begins in the building to another part, by applying the principle of compartmentation.

EXERCISE #2-1

Examine Figure 2-1. Take about 10 minutes to determine the minimum fire-resistance rating for the fire separations between the adjoining major occupancies based on Subsection 3.1.3. only. Write your answers on the Drawings. Are your determinations the same as those of the rest of the group?

You will observe that some combinations do not represent a hazard to each other. Consequently, the Table does not call for a fire separation. It is also important to note that a number of major occupancies are prohibited from being in the same building because of the perceived threat from one to another (i.e. see Article 3.1.3.2.). For this exercise, we are not concerned with other types of fire separations. Have group discussions as required. Class discussions will begin in about 10 minutes.

Notes ____

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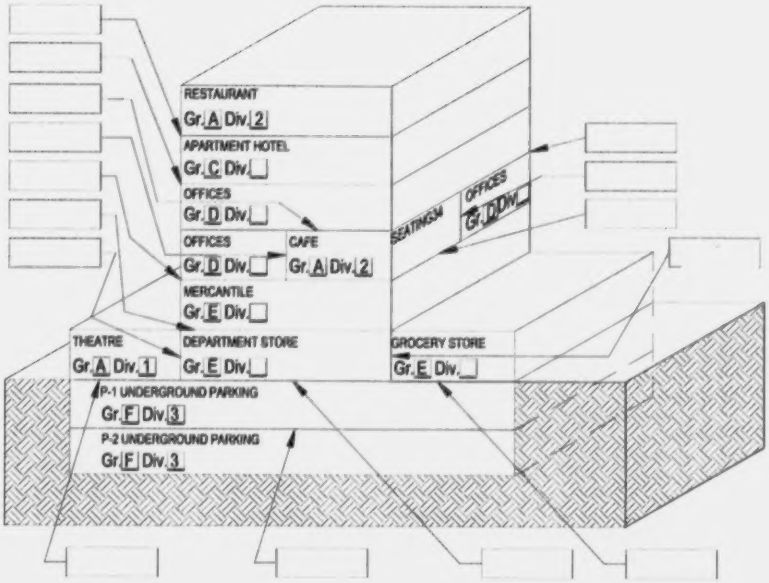
STOP

Minimum Fire-Resistance Rating of Fire Separations Between Adjoining Major Occupancies


RESTAURANT
Gr. A Div. 2
APARTMENT HOTEL
Gr. C Div. ☐
OFFICES
Gr. D Div. ☐
OFFICES
Gr. D Div. ☐
CAFE
Gr. A Div. 2
MERCANTILE
Gr. E Div. ☐
THEATRE
Gr. A Div. 1
DEPARTMENT STORE
Gr. E Div. ☐
GROCERY STORE
Gr. E Div. ☐
SEATING34
OFFICES
Gr. D Div. ☐
P-1 UNDERGROUND PARKING
Gr. F Div. 3
P-2 UNDERGROUND PARKING
Gr. F Div. 3

Schematic of uses for a multi-storey building not regulated by Subsection 3.2.6. Indicate fire-resistance ratings (in hours) beside arrows.

FIGURE 2-1

Table 2-1 can be used as a reference for determining the minimum required fire-resistance rating for a fire separation between adjoining major occupancies.

TABLE 2-1

Minimum Fire-Resistance Ratings Between Major Occupancies

Major Occupancy	Adjoining Major Occupancy	Minimum Fire-Resistance Rating of Fire Separation
A1	E	2 h
A1	F3	1 h
A2	C	1 h
B2	B3	1 h
B3	C	2 h
C	D	1 h
C	E	2 h plus 3.1.3.1.(2)
D	C	1 h
D	E	not required
E	A1	2 h
E	A2	2 h
E	F1	3 h
E	F3	not required

Note: Not all major occupancy combinations are shown.

NONCOMBUSTIBLE CONSTRUCTION (3.1.5.)

Buildings are classified in accordance with Subsection 3.2.2. in order to prevent fire spread and collapse caused by the effects of fire. The requirement to have the building constructed of noncombustible materials is determined from this Subsection. The principal factors involved in classification are building height, building area and occupancy. The occupancy of the building has a direct relationship with the probable fire loads that can be expected, under normal use, in the building. The building height and building area are measures used to determine the building exiting and firefighting potential.

Noncombustible construction means that, except for combustible items specifically permitted, all components of the building regulated by the Code must be noncombustible or:

a) have an average total heat release rate of not more than 3 MJ/m^2,

b) have an average smoke extinction area of not more than 1.0 m^2, and

c) have no further release of heat or smoke to the end of an extended test period,

when the material is tested in accordance with CAN/ULC-S135 [3.1.5.1.(2), (3) and (4)].

Many of the finish materials and other items not directly involved in the load carrying system can be of combustible materials.

When a building is required to be noncombustible construction, the materials, assembly of materials, and structural members are required to be of noncombustible construction, except as permitted by Articles 3.1.5.2. to 3.1.5.26., 3.1.13.4. (Light Diffusers and Lenses), and 3.2.2.16. (the authority to allow heavy timber roofs).

Permitted Combustibles

For obvious reasons, e.g. paper covering on gypsum wallboard, a building cannot be made from 100% noncombustible materials and products. Article 3.1.5.11. specifically mentions paper faced gypsum wallboard as a permitted combustible material in a building required to be of noncombustible construction. Articles 3.1.5.2. to 3.1.5.26 contain most of the exceptions that permit combustible components in a building or part of a building required to be of noncombustible construction. As you work with the exceptions, you will realize that individual exceptions have their own limitations and conditions.

Some requirements for permitted combustibles based on their flame spread ratings can be found in Part 6 covering HVAC (i.e. 6.2.3.2. for air duct sealants, 6.2.3.4. for duct coverings and linings).

STOP

The following Table 2-2 summarizes the types of combustible materials permitted for use in buildings required to be of noncombustible construction. Read the Articles carefully to fully understand the requirements.

Note: FSR refers to flame-spread rating
DWV refers to drain, waste and vent

TABLE 2-2

Article	Permitted Combustible Components	Description (Examples Only)
3.1.5.2.	Minor Combustible Components	• paint • mastics, caulking • firestop materials • tubing • similar minor components
3.1.5.3.	Roofing Materials	• Class A, B or C roof covering • roof sheathing • cant strips, curbs, etc.
3.1.5.4.	Glazing and Skylights	• skylights with limits on flame-spread ratings • vertical glazing • window sashes and frames
3.1.5.5.	Exterior Wall Components	• CAN/ULC-S134 test • thermal barriers • fire retardant treated wood
3.1.5.6.	Nailing Elements	• wood nailing elements < 50 mm thick
3.1.5.7.	Millwork	• trim, doors and door frames, handrails, shelves, etc.
3.1.5.8.	Flooring Elements	• stage flooring • raised platforms • finish flooring
3.1.5.9.	Stairs in Dwelling Units	

Article	Permitted Combustible Components	Description (Examples Only)
3.1.5.10.	Interior Finish	• paint, wallpaper, etc. < 1 mm thick • interior wall finishes < 25 mm thick FSR < 150 • interior ceiling finishes < 25 mm thick, FSR < 25
3.1.5.11.	Gypsum Wallboard	
3.1.5.12.	Insulation and its Protection	• other than foamed plastics FSR < 25 • foamed plastics with FSR < 25 with thermal barrier protection • insulation with FSR 25 < FSR < 500 protected with thermal barrier • insulation in high-rise buildings with thermal barriers • insulation, including foamed plastics above roof decks • thermosetting foamed plastics in factory built exterior wall panels with foam FSR < 500 and 10 minute ULC-S101 steel skin thermal barrier • foamed plastic insulation with FSR < 500 in interior or exterior wall or ceiling panels based on full scale room test
3.1.5.13.	Elements in Partitions	• wood framing • solid lumber partitions
3.1.5.14.	Storage Lockers in Residential Buildings	
3.1.5.15.	Combustible Ducts	• conforming to Part 6 requirements
3.1.5.16.	Piping Materials	• embedded in concrete • sprinkler piping • FSR <25 Polypropylene pipes/fittings in sprinklered buildings with other restrictions

Article	Permitted Combustible Components	Description (Examples Only)
3.1.5.17.	Plumbing Fixtures	• wall and ceiling enclosures based on flame-spread ratings and smoke developed classification
3.1.5.18.	Wires and Cables	• FT4 rated • FT6 rated
3.1.5.19.	Travelling Cables for Elevators	
3.1.5.20.	Nonmetallic Raceways	• FT4 rated not more than 175 mm outside in diameter (or equivalent area)
3.1.5.21.	Wires in Computer Room Floors	• FT1 rated • FT4 rated • FT6 rated
3.1.5.22.	Components in Public Pools and Spas	• fittings, ladders, liners, etc.
3.1.5.23.	Marquees having Combustible Elements	• exterior canopies CAN/ULC-S109 • exterior marquees
3.1.5.24.	Mezzanines	• within live/work unit based on size
3.1.5.25.	Wood decorative cladding	• conditioned to ASTM D 2898 before testing to CAN/ULC-S102
3.1.5.26	Combustible Solar Collection Systems	• above the roof

STOP

The following Table 2-3 forms a useful reference table for all Code requirements reflecting the need for a thermal barrier.

TABLE 2-3

Code	Description of Thermal Barrier	Insulation Material Located in Building Conditions
Sentence 3.1.5.12.(2)	• 12.7 mm gypsum board or lath & plaster, mechanically fastened • Masonry or concrete • Classification B tested to CAN4-S124-M	Foamed plastic, FSR < 25 in: • all locations in every building
Sentence 3.1.15.12.(3)	• 12.7 mm gypsum board with joints either backed or taped and filled or lath & plaster, mechanically fastened independent of insulation • 25 mm masonry or concrete Any thermal barrier meeting the temperature criteria after 10 min exposure to fire (CAN/ULC-S101-M)	Combustible insulation including foamed plastic with FSR > 25 but < 500 in exterior walls of: • unsprinklered buildings more than 18 m high • unsprinklered 3.2.6. buildings
Sentence 3.1.5.12.(4)	• 15.9 mm Type X gypsum board with joints backed or taped & filled, mechanically fastened independent of insulation • Nonloadbearing masonry/concrete > 50 mm • Loadbearing masonry/concrete > 75 mm • CAN/ULC-S101-M tested for 40 minutes, with 20 minute temperature rise rating	Combustible insulation including foamed plastic with FSR > 25 but < 500 in interior walls of: • unsprinklered buildings more than 18 m high • unsprinklered buildings constructed under Subsection 3.2.6.
Sentence 3.1.5.12.(6) **STOP**	• Factory assembled exterior wall panel, CAN/ULC-S101-M tested for ≥ 10 minutes and steel skins remain in place	Thermosetting foamed plastic insulation with FSR < 500 in exterior wall panels of: • Any building not more than 18 m high without Group B or C major occupancy

EXERCISE #2-2

1. In an unsprinklered building regulated by 3.2.6., combustible insulation with a flame-spread rating of less than 500 is permitted within ceilings provided it is protected by a thermal barrier consisting of the following:

   a) 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation.

   b) Any thermal barrier that meets the requirements of classification B when tested in conformance with CAN4-S124-M.

   c) 15.9 mm thick Type X gypsum board mechanically fastened to a supporting assembly independent of the insulation with all joints either backed or taped and filled.

   d) Sheet steel not less than 0.38 mm thick which will remain in place for not less than 10 minutes when tested in conformance with CAN/ULC-S101-M.

   ______________________________[________________]

2. What is the maximum permitted flame-spread rating for 5 mm thick combustible interior wall finishes (not foamed plastic) used in a building required to be of noncombustible construction?

   a) 25
   b) 50
   c) 150
   d) 500

   ______________________________[________________]

STOP

FIRE SEPARATIONS

The Nature of Fire Separations (3.1.8.)

The concept of fire separations is based on the principle of compartmentation. While Subsection 3.1.8. of the Code states the rules governing the construction of fire separations, other parts of the Code specify where they are required and whether or not they require a fire-resistance rating.

Continuous horizontal and vertical fire separations are constructed in order to form fire compartments. Fire separations impede fire, smoke, heat, flames and products of combustion from spreading from one fire compartment to another.

General Requirements for Fire Separations (3.1.8.1.)

The fire separations that form a fire compartment have three major requirements:

- They must be continuous.
- Any opening in the fire separation must be protected.
- May be required to have a fire-resistance rating.

Fire Separations and Fire-Resistance Ratings

Sometimes a fire separation does not require an FRR.

Although the fire separation is not required to have a fire-resistance rating, the fire separation is required to prevent the spread of fire until the suppression system has activated and controlled the fire within the fire compartment. In most buildings, the normal construction of the partitions and other subdividing assemblies would result in fire-resistance ratings of 10 to 15 minutes.

1. Fire Separations Without an FRR
    - The fire separation is designed as a continuous element of the compartment.

- Construction will hold back smoke, but is not evaluated to withstand the conditions of the standard fire test.
- The fire separations are built of materials that comply with the type of construction required for the building.
- Openings must still be protected. (i.e. noncombustible ducts that are not continuous must be provided with fire dampers).

While such materials could fail in flaming fire conditions, they would in the meantime prevent the passage of smoke to other parts of the building.

2. Fire Separations Having an FRR

- The fire separation is designed as a continuous element of the compartment and built of materials that comply with the type of construction required for the building.
- Construction will hold back both fire and smoke for a specific length of time.
- Openings must be protected by closures such as fire doors, fire dampers, wired glass or glass block.
- Such closures are required to have a fire protection rating.

3. Construction Requiring an FRR but Not Required to Act as a Fire Separation

- The assembly is built of materials that comply with the type of construction required for the building.
- Openings are not protected.
- The material, assembly of materials or structural member must possess a verifiable FRR.

In the Large Building - 2006 Course, the concept of fire separation and fire-resistance ratings is further investigated. The continuity of vertical fire separations and horizontal service spaces is also investigated in the Large Building Course.

STOP

CLOSURES (3.1.8.4., 3.1.8.5.)

General Overview

Most fire separations have openings through them. When this is the case, proper installation of closures is necessary to ensure that the fire compartment is effectively separated from the rest of the building. When assessing the adequacy of closures, the following must be taken into consideration:

- The labeled fire protection rating (FPR) of the closure
- Installation of a labeled frame
- Installation of labeled hardware
- Recognition of various referenced standards associated with closures
- The treatment accorded to untested closures.

The required fire protection rating of the closure is dependent on the fire-resistance rating of the fire separation in which it is installed [Table 3.1.8.4.].

Frame Installation

The frame is part of the closure that ensures the integrity of a fire separation at an opening. In a fire, a metal door will curve in the direction of the fire. The same holds true for fire windows or shutters. As a result, the frame for these closures must be securely anchored into the wall.

The exact opposite is true of fire dampers: they are positioned in a sleeve, which is loosely installed in the floor or wall.

Self-Closing Devices (3.1.8.11.)

Self-closing devices, like fire doors, are required to be labeled to ensure the required fire protection rating.

The Large Building - 2006 Course provides further insights into the requirements for self-closing devices.

Fire Dampers (3.1.8.7., 3.1.8.8., 3.1.8.9.)

A fire damper is a closure that protects an opening created by an air duct connecting two fire compartments. Its use is regulated by Articles 3.1.8.7. to 3.1.8.9. of the Code.

Additional information on fire dampers is provided in the Large Building - 2006 Course.

Latches or Locks (3.1.8.13.)

NFPA 80 states that a latching device is a spring-loaded latch bolt or a gravity operated steel bar that after release by physical action, returns to its operating position and automatically engages the strike plate when it is returned to the closed position.

The use of latches on fire doors is governed by Article 3.1.8.13. Remember that the terms lock and latch are used interchangeably. The function of either is to hold a fire door in the closed position under a fire condition. Locks and latches must be labeled to the required FPR, to maintain the listing of the fire door assembly.

Temperature Rise on Fire Doors (3.1.8.15., 3.1.8.17.)

Some fire doors are required to meet temperature rise criteria. The term temperature rise refers to the temperature developed on the unexposed face of the door when tested in conformance with CAN4-S104, "Fire Tests of Door Assemblies". Those labels that do not show temperature rise are for doors that develop temperature rises in excess of 250°C during the first 30 minutes of fire exposure (refer to Table 3.1.8.15).

EXERCISE #2-3

1. According to 3.1.8.15., the maximum temperature rise on the opaque portion of a 3 h fire door installed in a firewall with a required 4 h fire-resistance rating is:

   a) 250°C after 30 min
   b) 250°C after 1 h
   c) 250°C after 3 h
   d) No limit

   ______________________ [______________]

2. If the fire compartments on both sides of an interior fire separation are not sprinklered, what is the maximum size of opening that can be protected with a closure?

   a) 22 m^2 with no dimension more than 6 m

   b) 100 m^2 with no dimension more than 10 m

   c) No limit

   d) 11 m^2 with no dimension more than 3.7 m

   ______________________ [______________]

STOP

Building Services in Fire Separations and Fire Rated Assemblies, Firewalls, and Fire Stops in Concealed Spaces (3.1.9., 3.1.10. and 3.1.11.)

Firestopping and combustibility of service penetrations, firewalls and firestopping in concealed spaces are covered in the Large Building - 2006 Course.

STOP

FLAME-SPREAD RATING AND INTERIOR FINISHES

(3.1.12. and 3.1.13.)

Understanding the Code

At first reading, Subsection 3.1.13. appears to be very complicated. In reality, the surface burning characteristics (flame-spread rating and smoke developed classification) of interior finishes can be broken down among three types of buildings:

- Buildings permitted to be of combustible construction
- Buildings required to be of noncombustible construction
- High buildings regulated by Subsection 3.2.6.

The following Tables 2-4, 2-5, 2-6 and 2-7 summarize the requirements for flame-spread ratings (FSR) in buildings required to be of noncombustible construction.

Refer to notes in the Tables for further classification requirements.

In the Table column with the heading Maximum FSR, 'Surface' refers to the maximum surface flame-spread rating of the material tested in accordance with CAN/ULC-S102-M or

CAN/ULC-S102.2-M as appropriate.

'Cut test' refers to the requirements in 3.1.5. that contain the phrase "or any surface that would be exposed by cutting through the material in any direction", such as Clause 3.1.5.10.(2)(b).

TABLE 2-4

Noncombustible Construction, Unsprinklered

Occupancy, Location or Element		Maximum FSR		Code Reference(s) Sentences 3.1.13.2.(1), (4), (5); Table 3.1.13.2.
		Surface	Cut Test	
A1 Occupancies, Including Doors, Skylights, Glazing, Light Diffusers and Lenses	walls	75[1]	150[2]	as above, in header ☞Clause 3.1.5.10.(2)(b)
	ceiling	75[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Group B Occupancies Table 2-5	walls	n/a[9]	n/a[9]	must be sprinklered
	ceiling	n/a[9]	n/a[9]	must be sprinklered
Exits	walls	25[1]	25[1]	as above & 3.1.13.8.(1)(b)
	ceiling	25[3]	25[3]	as above & 3.1.13.8.(1)(b)
	floor	25	25	as above & 3.1.13.8.(1)(b)
Exterior Exit Passageways, Singly	walls	25[5]	25[5]	as above ☞Article 3.1.13.10.
	ceiling	25[5]	25[5]	as above ☞Article 3.1.13.10.
Exit Lobbies Regulated by Sentence 3.4.4.2.(2)	walls	25[6]	25[6]	as above ☞3.1.13.8.(1)(b)
	ceiling	25[3]	25[3]	as above ☞3.1.13.8.(1)(b)
Covered Vehicular Passageways, Except Heavy Timber Roof Assemblies	walls	25[1]	150[2]	as above ☞3.1.5.10.(2)(b)
	ceiling	25[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Vertical Service Spaces	walls	25[1]	150[2]	as above ☞3.1.5.10.(2)(b)
	ceiling	25[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Doors, Except A1 Occupancies		200[7]	—	Sentences 3.1.13.2.(2), (3)
Bathrooms within Group C Occupancies	walls	200	—	as above ☞Article 3.1.13.3.
	ceiling	200	—	as above ☞Article 3.1.13.3.
Corridors, Public & Other Types Not within Suites or Rooms	walls	75[8]	150[2]	as above ☞Article 3.1.13.6.(1)(a)
	ceiling	25[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Plenums, All Surfaces	SDC: 50	25	—	Clause 3.6.4.3.(1)(a)

Other Areas	walls	150	150[2]	Clause 3.1.5.10.(2)(b)
	ceiling	150	25[4]	Clause 3.1.5.10.(3)(b)

1 Sentences 3.1.13.2.(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR < 150.
2 Maximum cross-sectional FSR for combustible interior wall finishes.
3 Sentences 3.1.13.2.(4) & (5): 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1 occupancies, FSR < 150.
4 Maximum cross-sectional FSR for combustible interior ceiling finishes.
5 Article 3.1.13.10.: up to 10% of total wall/ceiling area FSR < 150.
6 Sentences 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR < 150.
7 Sentence 3.1.13.2.(3): no limit on FSR where door is in a dwelling unit.
8 Sentence 3.1.13.6.(2), upper half of wall FSR < 25 and lower half of wall FSR < 150.
9 Articles 3.2.2.36. ☞ 3.2.2.41. require B occupancies to be sprinklered.

TABLE 2-5

Noncombustible Construction, Sprinklered

Occupancy, Location or Element		Maximum FSR		Code Reference(s) Sentence 3.1.13.2.(1) Table 3.1.13.2.
		Surface	Cut Test	
A1 Occupancies, Including Doors, Skylights, Glazing, Light Diffusers and Lenses	walls	*150*[2]	*150*[1]	as above ☞Clause 3.1.5.10.(2)(b)
	ceiling	*25*[2]	*25*[3]	as above ☞Clause 3.1.5.10.(3)(b) & 3.1.13.8.(1)(a)
Group B Occupancies	walls	*150*	*150*[1]	as above ☞Clause 3.1.5.10.(2)(b)
	ceiling	*25*[2]	*25*[3]	as above ☞Clause 3.1.5.10.(3)(b) & 3.1.13.8.(1)(a)
Exits	walls	*25*[4]	*25*[4]	as above
	ceiling	*25*[2]	*25*[2]	as above ☞Clause 3.1.5.10.(3)(b)
	floor	*25*	*25*	as above & Clause 3.1.13.8.(1)(b)
Exterior Exit Passageways, Singly	walls	*25*[5]	*25*[5]	as above ☞Article 3.1.13.10.
	ceiling	*25*[5]	*25*[5]	as above ☞Article 3.1.13.10.
Exit Lobbies Regulated by Sentence 3.4.4.2.(2)	walls	*25*[6]	*25*[6]	as above
	ceiling	*25*[2]	*25*[2]	as above ☞Clause 3.1.5.10.(3)(b)
Covered Vehicular Passageways, Except Heavy Timber Roof Assemblies	walls	*25*[4]	*150*[1]	as above
	ceiling	*25*[2]	*25*[3]	as above ☞Clause 3.1.5.10.(3)(b)
Vertical Service Spaces	walls	*25*[4]	*150*[1]	as above
	ceiling	*25*[3]	*25*[3]	as above ☞Clause 3.1.5.10.(3)(b)
Doors, Except A1 Occupancies		*200*	—	Sentences 3.1.13.2.(2), (3)
Bathrooms within Group C Occupancies	walls	*200*	—	as above ☞Article 3.1.13.3.
	ceiling	*200*	—	as above ☞Article 3.1.13.3.

Corridors, Public & Other Types Not within Suites or Rooms	walls	*150*	*150*	as above ☞Clause 3.1.5.10.(2)(b)
	ceiling	*25^2*	*25^3*	as above ☞Clause 3.1.5.10.(3)(b)
Plenums, All Surfaces	SDC: 50	25	—	Clause 3.6.4.3.(1)(a)
Other Areas	walls	*150^1*	*150^1*	as above ☞Clause 3.1.5.10.(2)(b)
	ceiling	*150^1*	*25^3*	as above ☞Clause 3.1.5.10.(3)(b)

1 Maximum cross-sectional FSR for combustible interior wall finishes.

2 Sentences 3.1.13.2.(4) & (5), 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1 occupancies, FSR < 150.

3 Maximum cross-sectional FSR for combustible interior ceiling finishes.

4 Sentences 3.1.13.2(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR < 150.

5 Article 3.1.13.10.: up to 10% of total wall/ceiling area, FSR < 150.

6 Sentences 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR < 150.

TABLE 2-6

Combustible Construction, Unsprinklered

Occupancy, Location or Element		Maximum FSR (Surface Flame Spread)	Code Reference(s) Sentences 3.1.13.2.(1), (4), (5): Table 3.1.13.2.
A1 occupancies, including doors, skylights, glazing, light diffusers & lenses	walls	75[1]	as above, in header
	ceiling	75[2]	as above
Group B occupancies	walls	n/a[7]	
	ceiling	n/a[7]	
Exits	walls	25[1]	as above
	ceiling	25[2]	as above
Exterior exit passageways, singly	walls	25[3]	as above ☞Article 3.1.13.10.
	ceiling	25[3]	as above ☞Article 3.1.13.10.
Exit lobbies regulated by Sentence 3.4.4.2.(2)	walls	25[4]	as above
	ceiling	25[2]	as above
Covered vehicular passageways, except heavy timber roof assemblies	walls	25[1]	as above
	ceiling	25[2]	as above
Vertical service spaces	walls	25[1]	as above
	ceiling	25[2]	as above
Doors, except A1 occupancies		200[5]	Sentences 3.1.13.2.(2), (3)
Doors, within residential suites		no limit	Sentence 3.1.13.2.(3)
Bathrooms with Group C occupancies	walls	200	as above ☞Article 3.1.13.3.
	ceiling	200	as above ☞Article 3.1.13.3.

Corridors, public and other types not within suites or rooms	walls	75[6]	as above ☞Clause 3.1.13.6.(1)(a)
	ceiling	25	as above ☞Sentence 3.1.13.6.(2)
Plenums, all surfaces	SDC: 50	25	Clause 3.6.4.3.(1)(a)
Other areas	walls	150	Sentence 3.1.13.2.(1)
	ceiling	150	Sentence 3.1.13.2.(1)

1 3.1.13.2.(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1, FSR $\leq$ 150.

2 3.1.13.2.(4) & (5): 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1, FSR $\leq$ 150.

3 Article 3.1.13.10.: up to 10% of total wall/ceiling area FSR $\leq$ 150.

4 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1, FSR $\leq$ 150.

5 Sentence 3.1.13.2.(3): no limit on FSR where door is in a dwelling unit.

6 Clause 3.1.13.6.(1)(b), or upper half of wall FSR $\leq$ 25 and lower half of wall FSR $\leq$ 150.

7 Articles 3.2.2.36. ☞3.2.2.41. Require sprinklers.

TABLE 2-7
Combustible Construction, Sprinklered

Occupancy, Location or Element		Maximum FSR (Surface Flame Spread)	Code Reference(s) Sentences 3.1.13.2.(1); Table 3.1.13.2.
A1 occupancies, including doors, skylights, glazing, light diffusers & lenses	walls	150	as above, in header
	ceiling	150	as above
Group B occupancies	walls	150	as above
	ceiling	150	as above
Exits	walls	25[1]	as above
	ceiling	25[2]	as above
Exterior exit passageways, singly	walls	25[3]	as above ☞Article 3.1.13.10.
	ceiling	25[3]	as above ☞Article 3.1.13.10.
Exit lobbies regulated by Sentence 3.4.4.2.(2)	walls	25[4]	as above
	ceiling	25[2]	as above
Covered vehicular passageways, except heavy timber roof assemblies	walls	25[1]	as above
	ceiling	25[2]	as above
Vertical service spaces	walls	25[1]	as above
	ceiling	25[2]	as above
Doors, except A1 occupancies		200[5]	Sentences 3.1.13.2.(2), (3)
Doors, within residential suites		no limit	Sentence 3.1.13.2.(3)
Bathrooms within Group C occupancies	walls	200	as above ☞Article 3.1.13.3.
	ceiling	200	as above ☞Article 3.1.13.3.

Corridors, public and other types not within suites or rooms	walls	150	Sentence 3.1.13.2.(1)
	ceiling	150	Sentence 3.1.13.2.(1)
Plenums, all surfaces	SDC: 50	25	Clause 3.6.4.3.(1)(a)
Other areas	walls	150	Sentence 3.1.13.2.(1)
	ceiling	150	Sentence 3.1.13.2.(1)

1 3.1.13.2.(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1,
FSR < 150.

2 3.1.13.2.(4) & (5): 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1,
FSR < 150.

3 Article 3.1.13.10.: up to 10% of total wall/ceiling area FSR < 150.

4 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1,
FSR < 150.

5 Sentence 3.1.13.2.(3): no limit on FSR where door is in a dwelling unit.

EXERCISE #2-4

1. What Standard test is required to be used to test for determining the flame-spread rating of a thermoplastic foamed plastic insulation?

   a) CAN/ULC-S102.2

   b) CAN/ULC-S102

   c) ULC-S102.3

   d) CAN/ULC-S101

   ______________________________ [____________]

2. What is the maximum permitted frame spread rating for the interior wall finish of a corridor serving classrooms in an unsprinklered high school?

   a) 25

   b) 75

   c) 150

   d) 300

   ______________________________ [____________]

3. According to Article 3.1.13.2. the maximum permitted flame-spread rating for doors installed within a dwelling unit is?

   a) 150

   b) No limit

   c) 200

   d) 25

   ______________________________ [______________]

STOP

HIGH BUILDINGS (3.1.13.7.)

Only in high buildings, regulated by the provisions of Subsection 3.2.6., are maximum smoke developed classifications (SDC) for interior finishes regulated.

The test standards used for determining smoke developed classifications are the same as those used for flame-spread ratings.

Table 3.1.13.7. identifies the maximum flame-spread ratings and smoke developed classifications in high buildings.

Except for buildings of Group B major occupancies and elevator cars, Table 3.1.13.7. does not apply if the building is sprinklered and the sprinkler system is electrically supervised [3.1.13.7.(2)].

Table 3.1.13.7.
Flame-Spread Rating and Smoke Developed Classification in a High Building
Forming Part of Sentence 3.1.13.7.(1)

Location or Element	**Maximum Flame-Spread Rating**			**Maximum Smoke Developed Classification**		
	Wall Surface	Ceiling Surface [1]	Floor Surface	Wall Surface	Ceiling Surface [1]	Floor Surface
Exit stairways, vestibules to exit stairs and lobbies described in Sentence 3.4.4.2.(2)	25	25	25	50	50	50
Corridors not within suites	[2]	[2]	300	100	50	500
Elevator cars and vestibules	25	25	300	100	100	300
Service spaces and service rooms	25	25	25	50	50	50
Other locations and elements	[2]	[2]	No limit	300	50	No limit
Column 1	2	3	4	5	6	7

Note to Table 3.1.13.7.:

[1] See Sentence 3.1.13.4.(1) for lighting elements.
[2] Other requirements of this Part apply.

STOP

EXERCISE #2-5

1. According to Article 3.1.13.7. in an unsprinklered building regulated by 3.2.6., the maximum frame-spread rating, X and smoke developed classification, Y for the floor surface of an elevator car is expressed (X/Y):

   a) 25/50

   b) 25/100

   c) 25/300

   d) 300/300

   ______________________ [__________]

2. The maximum permitted flame-spread rating and smoke developed classification for trim covering 11% of the wall surface area of a public corridor (not within a suite) in an unsprinklered building regulated under 3.2.6. is:

   a) 150/300

   b) 75/no limit

   c) (25 for upper half of wall, 150 on lower half)/no limit

   d) 75/100

   ______________________ [__________]

Fabrics (3.1.16.)

Fabrics are reviewed in the Large Building - 2006 Course.

Occupant Load (3.1.17.)

Occupant load determination is reviewed in the Large Building - 2006 Course.

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PARTICIPANT MODULE 3

COMPLEX BUILDINGS - 2006

SUPPLEMENTARY STANDARD SB-2

FIRE PERFORMANCE RATINGS

3.1 INTRODUCTION

Fire-resistance ratings of assemblies are established by tests or by information contained in the Supplementary Standard. Floor/ceiling assemblies are rated for fire exposure from the underside of the assembly only. Interior walls and partitions are rated for fire exposure from each side. Exterior walls are rated for fire exposure only from within the building.

In this Module, we will study the methods used for determining 'fire-resistance ratings' of materials and assemblies, 'fire protection ratings' of closures and surface burning characteristics of building materials.

Objectives

- Determine the nature of fire separations and understand the concept of fire-resistance rating.
- Provide an understanding of the requirements of the Code relating to flame spread ratings of materials.
- Reference applicable standards.

3.2 OVERVIEW

Read definitions on your own time.

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text. Defined terms will not be shown in italics in this module, other than in this section.

Building area
Building area means the greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.

Closure
Closure means a device or assembly for closing an opening through a fire separation or an exterior wall, such as a door, a shutter, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

Combustible
Combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Test for Determination of Noncombustibility in Building Materials".

Combustible construction
Combustible construction means that type of construction that does not meet the requirements for noncombustible construction.

Fire damper
Fire damper means a closure which consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly, and designed to close automatically in the event of a fire in order to maintain the integrity of the fire separation.

Fire protection rating
Fire protection rating means the time in minutes or hours that a closure will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this Code.

Fire-resistance rating
Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test as prescribed in this Code.

Fire separation
Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Firewall
Firewall means a type of fire separation of noncombustible construction which subdivides a building or separates adjoining buildings to resist the spread of fire and which has a fire-resistance rating as prescribed in this Code and has structural stability to remain intact under fire conditions for the required fire-rated time.

Flame spread rating
Flame spread rating means an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test as prescribed in this Code.

Noncombustible
Noncombustible means that a material meets the acceptance criteria of CAN4-S114, "Test for Determination of Noncombustibility in Building Materials".

Noncombustible construction
Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.

Partition
Partition means an interior wall, one storey, or part storey in height that is not loadbearing.

3.3 FIRE-RESISTANCE RATINGS (Section 3.1.7.)

Fire-resistance ratings are the ratings assigned to materials, and assemblies of materials, when tested in accordance with the Standard CAN/ULC-S101-M, "Fire Endurance Tests of Building Construction and Materials" [3.1.7.1.(1)].

The ratings are expressed as a period of time (i.e. 30 min, 45 min, 1 h, 1½ h, 2 h, etc.) and represent the period of time that a test assembly has withstood the passage of flame and transmission of heat when exposed to fire under specified conditions of test and performance criteria.

The test applies to floors, roofs, walls, partitions, columns and beams. It also applies to ceiling assemblies and protective membranes for foamed plastics (thermal barriers).

Materials and assemblies of materials are also permitted to be assigned fire-resistance ratings on the basis of the Supplementary Standard SB-2 [3.1.7.1.(2)].

Articles 3.1.7.2. and 3.1.7.3. describe the conditions for waiving the temperature rise limits in CAN/ULC-S101on exterior walls and the exposure conditions for floors, roofs and ceilings, firewalls and exterior walls.

3.4 FIRE PERFORMANCE RATINGS (SB-2)

Supplementary Standard SB-2 forms part of the Building Code. The information contained in SB-2 is referenced throughout Part 3 and Part 9.

In this section, we will examine the contents of Supplementary Standard SB-2 as it relates to the requirements found in Part 3.

We will study the methods used for calculating fire-resistance ratings, using 'generic materials' that can be described using referenced product standards. We will learn how to use the Tables providing ratings of materials for flame-spread, smoke developed classifications, and noncombustibility. The Large Buildings course provides further review of SB-2.

Objectives

- Provide an understanding of where to locate information on fire-resistance ratings, flame-spread ratings, smoke developed classifications, noncombustibility and protection of openings in fire-rated assemblies.
- Calculate equivalent thicknesses.
- Calculate fire-resistance ratings of assemblies using the 'component additive method'.
- Calculate M/D ratios for steel columns.
- Reference applicable standards.

Read SB-2, page 1 from beginning to 1.1.1.(3).

SB-2 is formatted into 6 sections. The contents of these sections are summarized in Table 3-1.

TABLE 3-1

Table of Contents

Section	Title	Part of Section	Content
1	General	1.1	Introduction
		1.2	Interpretation of Test Results
		1.3	Concrete
		1.4	Types of Concrete
		1.5	Gypsum Wallboard
		1.6	Equivalent Thickness
		1.7	Contribution of Plaster or Gypsum Wallboard Finish to Fire Resistance of Masonry or Concrete
		1.8	Tests of Floors and Roofs
		1.9	Moisture Content
		1.10	Permeance and Durability
		1.11	Steel Structural Members
		1.12	Restraint Effects
2	Fire-Resistance Ratings	2.1	Masonry and Concrete Walls
		2.2	Reinforced and Prestressed Concrete Floor and Roof Slabs
		2.3	Wood and Steel Framed Walls, Floors and Roofs
		2.4	Solid Wood Walls, Floors and Roofs
		2.5	Solid Plaster Partitions
		2.6	Protected Steel Columns
		2.7	Individually Protected Steel Beams
		2.8	Reinforced Concrete Columns
		2.9	Reinforced Concrete Beams
		2.10	Prestressed Concrete Beams
		2.11	Glue-Laminated Timber Beams and Columns
3	Flame-Spread Ratings and Smoke Developed Classifications	3.1	Interior Finish Materials
4	Noncombustibility	4.1	Test Method
		4.2	Materials Classified as Combustible
		4.3	Materials Classified as Noncombustible
5	Protection of Openings in Fire Rated Assemblies	5.1	Scope
		5.2	Installation of Fire Doors and Fire Dampers
		5.3	Fire Stop Flaps
6	Background Information	6.1	Fire Test Reports
		6.2	Obsolete Materials and Assemblies
		6.3	Assessment of Archaic Assemblies
		6.4	Development of the Component Additive Method

3.5 GENERAL

The ratings found in SB-2 apply if more specific test values cannot be found [1.1.3.]. Additional information on fire rated assemblies containing materials that cannot be found in a standard such as those found in Table 1.1.2, can be found at certification organizations accredited by the Standards Council of Canada. Subsection 1.1.5. provides some sources of this information.

The fire-resistance ratings for assemblies incorporating concrete are affected by the type of concrete, the aggregates in the concrete, its density and its thickness when used. Generally, low density aggregates exhibit better fire performance than natural stone or normal density concrete [1.3.1.].

If it is not possible to determine the nature of the concrete aggregate, the aggregate shall be considered to be in the group that requires that greater thickness of concrete for the required fire-resistance [1.4.2.].

STOP

3.6 EQUIVALENT THICKNESS

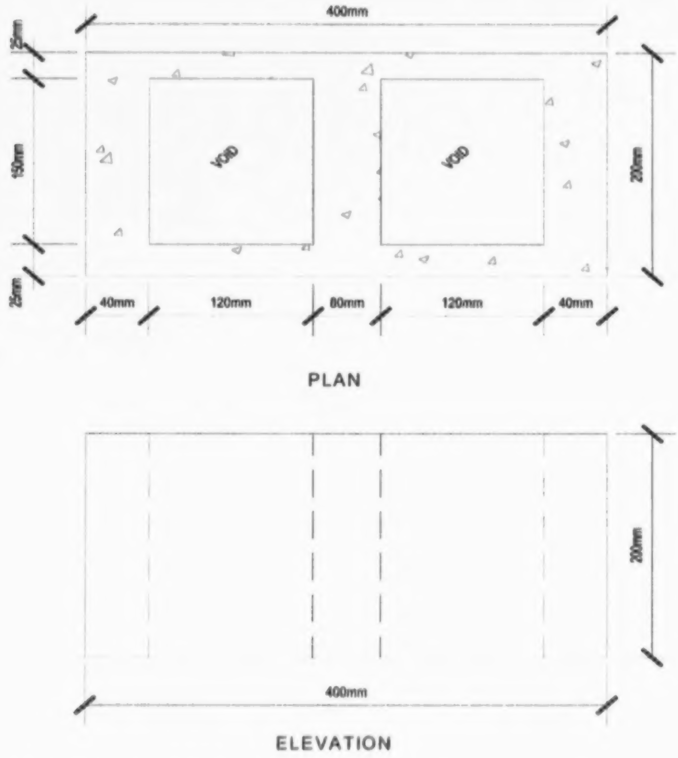
Read Subsection 1.6.1. and complete Exercise #3-1.

EXERCISE #3-1

1. For the masonry unit (concrete block) shown in Figure 3-1, calculate the equivalent thickness. Give SB-2 Sentence(s) used.

STOP

Masonry Unit


400mm
25mm
150mm
25mm
VOID
VOID
200mm
40mm
120mm
80mm
120mm
40mm
PLAN
200mm
400mm
ELEVATION

Note:

Use actual dimensions, not nominial dimensions.

FIGURE 3-1

3.7 FIRE-RESISTANCE RATINGS

3.7.1 Concrete/Masonry Walls

Fire-resistance of masonry and concrete walls is determined from Table 2.1.1. Ratings of up to 4 h are available. This applies to both loadbearing and non-loadbearing walls.

3.7.2 Concrete Floors

Fire-resistance of concrete floor and roof slabs is determined using Table 2.2.1.A for the minimum thickness of the slabs for various concrete types, and Table 2.2.1.B for the minimum concrete cover over the reinforcement in the slabs [2.2.1.(1), and 2.2.1.(2)].

3.7.3 Wood and Steel Framed Walls, Roofs and Floors

Read 2.3.1. to 2.3.4. of SB-2 and complete Exercise #3-2.

Take special note that the maximum fire-resistance rating that can be determined using SB-2 Section 2.3 is 90 minutes [2.3.1.(1)].

EXERCISE #3-2

1. Calculate the fire-resistance rating for the non-loadbearing wall assembly shown on the attached Figure 3-2. Give SB-2 references for your answer.

Fire-Resistance Rating, Interior Vertical Fire Separation

FUGURE 3-2: COMPLEX BUILDINGS

Figure 3-2

Fire-Resistance Rating, Interior Vertical Fire Separation
(non loadbearing)

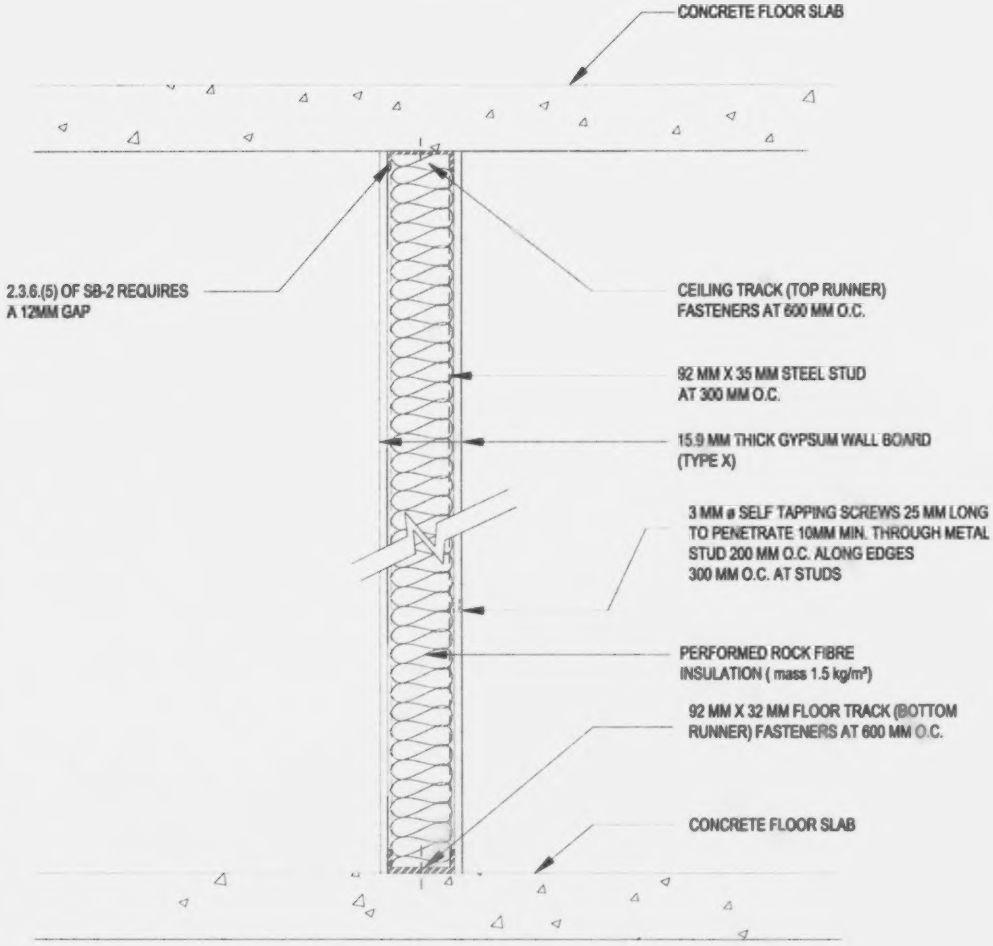

CONCRETE FLOOR SLAB
2.3.6.(5) OF SB-2 REQUIRES A 12MM GAP
CEILING TRACK (TOP RUNNER) FASTENERS AT 600 MM O.C.
92 MM X 35 MM STEEL STUD AT 300 MM O.C.
15.9 MM THICK GYPSUM WALL BOARD (TYPE X)
3 MM ø SELF TAPPING SCREWS 25 MM LONG TO PENETRATE 10MM MIN. THROUGH METAL STUD 200 MM O.C. ALONG EDGES 300 MM O.C. AT STUDS
PERFORMED ROCK FIBRE INSULATION (mass 1.5 kg/m³)
92 MM X 32 MM FLOOR TRACK (BOTTOM RUNNER) FASTENERS AT 600 MM O.C.
CONCRETE FLOOR SLAB

FIGURE 3-2

The remainder of Section 2.3 provides additional guidance on wood and steel framed walls, floors and roofs. Participants should familiarize themselves with the sample calculations in Section 1.7.4. of SB-2. Table 3-2 summarizes various sections of 2.3.

TABLE 3-2

Subsection (Sentence)	Guidance Provided
2.3.5. (1)	no contribution for membrane on non-fire side of wall
(2)	exterior wall insulation and exterior sheathing
(3)	upper membrane of floor or roof assemblies
(4)	attachment of insulation in wood floor assemblies
2.3.6.	Description of framing members
2.3.7.	Plaster finish thickness
2.3.8.	Edge support for attachment of gypsum wallboard
2.3.9.	Fastener spacing and length for plaster and gypsum wallboard
2.3.10.	Permitted openings in ceiling membranes of floors or roofs of combustible construction
2.3.11.	Permitted opening in ceiling membranes of floors or roofs of noncombustible construction
2.3.12.	Ratings for ceiling membranes only
2.3.13.	Beams in floor or roof assemblies
2.3.14.	Wired glass assemblies

STOP

3.7.4 Columns

Read 2.6.1. to 2.6.5. and complete Exercise #3-3.

EXERCISE #3-3

1. Calculate the mass/heated perimeter (M/D) ratio for the steel column shown in Figure 3-3 and determine its maximum fire-resistance rating, if it is protected with 38.1 mm of gypsum wallboard, and installed in accordance with 2.6.5. The mass of the column is 113 kg/m.

   Give SB-2 references with your answers.

Steel Column

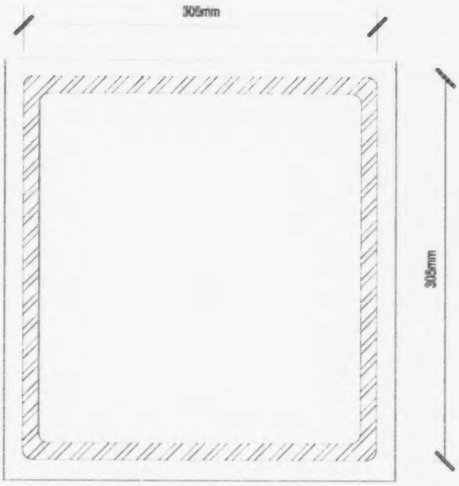


FIGURE 3-3

3.8 BEAMS

The Large Buildings - 2006 course provides information on the fire-resistance ratings for individual protected steel beams.

3.9 FLAME SPREAD RATINGS SMOKE DEVELOPED CLASSIFICATIONS (Section 3) NONCOMBUSTIBILITY (Section 4) PROTECTION OF OPENINGS (Section 5)

Section 3 provides flame spread ratings and smoke developed classifications on materials that can be described generically and have an associated product standard.

The ratings are expressed as Y/YY

where Y is the flame spread rating and YY is the smoke developed classification (see 3.1.3.).

The ratings provided in Tables 3.1.1.A (wall and ceiling finishes) and Table 3.1.1.B (floor finishes) are maximum expected ratings corresponding to requirements found in Division B, Parts 3 and 9. Actual test results for these materials may be lower than the values given in these tables.

Section 4 provides examples of typical materials that are noncombustible when tested in accordance with CAN4-S114 "Test For Determination of Noncombustibility in Building Materials".

Section 5 provides guidance on the installation of fire doors and fire dampers in gypsum wallboard protected wood stud and steel stud framed walls.

Section 5 also provides a description of the ceiling firestop flap that must be used to protect openings in membrane ceilings described in Subsections 2.3.10. and 2.3.11. of SB-2.

EXERCISE #3-4

1. What is the flame spread rating of 12.7 mm thick unfinished poplar plywood (without cellulose resin overlay)? Give material Standard in your answer.

   ____________________ [____________]

2. What is the smoke developed classification of woven wool carpet, with a pile weight of 1500 g/m^2, applied without felt underlay? Give material Standard, including date, in your answer.

   ____________________ [____________]

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PARTICIPANT MODULE 4

COMPLEX BUILDINGS - 2006

BUILDING FIRE SAFETY

4.1 INTRODUCTION

This module encompasses Building Code Subsection 3.2.1. "General", Subsection 3.2.2. "Building Size and Construction Relative to Occupancy" and Subsection 3.2.3. "Spatial Separation and Exposure Protection".

Subsection 3.2.1. "General"

Prior to determining the construction requirements of a building the building height must be assessed. The height of a building can significantly influence the construction requirements for the building. This includes items such as (but not limited to):

- required construction type (i.e. either combustible or noncombustible construction);
- provision of sprinkler protection;
- additional measures required for high buildings; and
- structural fire-resistance ratings.

The height of a proposed building can be influenced by various design elements. These include, for example, the grade around the building, the presence of mezzanines and the use of rooftop mechanical spaces.

The Part 3 Users' Guide to the 2005 model National Building Code of Canada offers the following information on building size determination:

"Establishing grade can pose problems for the authority having jurisdiction, since in certain large complexes it is extremely difficult to determine where the grade should be or where the ground level is . . . This could mean the difference between a requirement for noncombustible construction or permission for combustible construction, or it could mean the difference between a one hour or a two hour fire-resistance rating for the structural assemblies. If the ground is sloped up to a building, this will affect fire fighting operations. A reasonably level area should be provided around the building to allow the use of ladders and the deployment of fire fighters. The slopes should be gentle to ensure that the ground will not settle and leave the building in contravention of the NBC 2005. If the effect of the grading is to reduce the internal fire safety measures, care has to be taken that the occupants are not exposed to an increased risk. Therefore, reason and judgement must be exercised in establishing grade, taking into account exiting and fire fighting."

This Subsection also includes requirements regulating parking garages (storage garages), determination of whether a roof is a wall as well as ratings and containment of fire in basements. For the purpose of this module, only those additional requirements pertaining to storage garages will be addressed.

Subsection 3.2.2. "Building Size and Construction Relative to Occupancy"

The significance of this Subsection of the Building Code cannot be understated. Construction classification underpins key principles of the Building Code concerning life safety, containment of smoke and fire and reduction of the probability of the collapse of a building from the effects of fire.

This portion of the module will focus on determination of the structural fire protection requirements for buildings. As noted above, these include regulations governing the construction type (i.e. combustible or noncombustible construction), requirements for provision of sprinkler protection and fire-resistance ratings of floor assemblies, mezzanines, roof assemblies and loadbearing walls, columns and arches.

Factors such as major occupancy classification, building height, and number of streets are important concepts from Subsection 3.2.1. which influence the construction classification of a building.

Subsection 3.2.3. "Spatial Separation and Exposure Protection"

Buildings located in close proximity to each other, or where windows occur in exterior walls of separate fire compartments, present the possibility of fire spread from one building to another by thermal radiation through windows.

Minimum fire-resistance rating and combustibility of construction of an exposed building face, assist in control of a fire in a subject building, from a fire originating outside the building by use of noncombustible cladding when required.

This section of the module will concentrate on requirements in the Building Code for determining limiting distances between fire compartments and the construction of an exposing building face.

Objectives

- Identify exceptions to building height.
- Provide an understanding of the code intent and application of spatial separation requirements.
- Understand the basis for the factors that regulate the requirements of spatial separations, including limiting distance and the area of unprotected openings.
- Identify the effect of multiple major occupancies on construction classification.
- Explain the concept of "streets" and identify its effect on construction classification.
- Outline construction classification requirements for buildings.

4.2 DEFINITIONS

The following terms from the Building Code, Division A, Part 1, Article 1.4.1.2., used in this module, are defined. The definitions provided below are for information purposes only. Reference should be made to the respective definition in the official volume of the Code.

Assembly
Assembly occupancy means the occupancy or the use of a building, or part of a building, by a gathering of persons for civic, political, travel, religious, social, educational, recreational or similar purposes or for the consumption of food or drink.

Basement
Basement means one or more storeys of a building located below the first storey.

Building area
Building area means the greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.

Building height
Building height means the number of storeys contained between the roof and the floor of the first storey.

Business and personal services occupancy
Business and personal services occupancy means the occupancy or use of a building or part of a building for the transaction of business or the rendering or receiving of professional or personal services.

Combustible
Combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Test for Determination of Non-combustibility in Building Materials".

Combustible construction

Combustible construction means a type of construction that does not meet the requirements for noncombustible construction.

Exposing building face

Exposing building face means that part of the exterior wall of a building which faces one direction and is located between ground level and the ceiling of its top storey, or where a building is divided into fire compartments, the exterior wall of a fire compartment that faces one direction.

Exterior cladding

Exterior cladding means those components of a building that are exposed to the outdoor environment and are intended to provide protection against wind, water or vapour.

Fire compartment

Fire compartment means an enclosed space in a building that is separated from all other parts of the building by enclosing construction that provides a fire separation and that may be required to have a fire-resistance rating.

Fire-resistance rating

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test and performance as prescribed in this Code.

Fire separation

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Firewall

Firewall means a type of fire separation of noncombustible construction that subdivides a building or separates adjoining buildings to resist the spread of fire and that has a fire-resistance rating as prescribed in this Code and the structural stability to remain intact under fire conditions for the required fire-rated time.

First storey

First storey means the storey with its floor closest to grade and its ceiling more than 1.8 m above grade.

Floor area

Floor area means the space on any storey of a building between exterior walls and required firewalls, including the space occupied by interior walls and partitions, but not including exits, vertical service spaces, and their enclosing assemblies.

Grade

Grade means the average level of proposed or finished ground adjoining a building at all exterior walls.

High hazard industrial occupancy

High hazard industrial occupancy (Group F, Division 1) means an industrial occupancy containing sufficient quantities of highly combustible and flammable or explosive materials to constitute a special fire hazard because of their inherent characteristics.

Industrial occupancy

Industrial occupancy means the occupancy or use of a building or part of a building for the assembling, fabricating, manufacturing, processing, repairing or storing of goods or materials.

Limiting distance

Limiting distance means the distance from an exposing building face to a property line, the centre line of a street, lane or public thoroughfare or to an imaginary line between two buildings or fire compartments on the same property, measured at right angles to the exposing building face.

Low hazard industrial occupancy

Low hazard industrial occupancy (Group F, Division 3) means an industrial occupancy in which the combustible content is not more than 50 kg/m^2 or 1200 MJ/m^2 of floor area.

Major occupancy

Major occupancy means the principal occupancy for which a building or part of a building is used or intended to be used, and is deemed to include the subsidiary occupancies that are an integral part of the principal occupancy.

Medium hazard industrial occupancy

Medium hazard industrial occupancy (Group F, Division 2) means an industrial occupancy in which the combustible content is more than 50 kg/m^2 or 1200 MJ/m^2 of floor area and that is not classified as a high hazard industrial occupancy.

Mercantile occupancy

Mercantile occupancy means the occupancy or use of a building or part of a building for the displaying or selling of retail goods, wares or merchandise.

Mezzanine

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or storey and includes an interior balcony.

Noncombustible

Noncombustible means that a material meets the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Non-combustibility in Building Materials".

Noncombustible construction

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.

Occupancy

Occupancy means the use or intended use of a building or part of a building for the shelter or support of persons, animals or property.

Public way

Public way means a sidewalk, street, highway, square or other open space to which the public has access, as of right or by invitation, expressed or implied.

Residential occupancy

Residential occupancy means the occupancy or use of a building or part of a building by persons for whom sleeping accommodation is provided but who are not harboured or detained there to receive medical care or treatment or who are not involuntarily detained there.

Service room

Service room means a room provided in a building to contain equipment associated with building services.

Service space

Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Sprinklered

Sprinklered means equipped with a system of automatic sprinklers.

Storage garage

Storage garage means a building or part of a building that is intended for the storage or parking of motor vehicles and that contains no provision for the repair or servicing of motor vehicles.

Storey

Storey means, except for the purposes of Part 7 of Division B, the portion of a building that is situated between the top of any floor and the top of the floor next above it, or that is situated between the top of the floor and the ceiling above the floor, if there is no floor above.

Street

Street means any highway, road, boulevard, square or other improved thoroughfare that is 9 m or more in width, that has been dedicated or deeded for public use and that is accessible to fire department vehicles and equipment.

Suite
Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories and individual stores and individual or complementary rooms for business and personal services occupancies.

The Part 3 Users' Guide to the National Building Code of Canada provides useful insight into the intention behind the tenure concept:

"Tenancy in the context of the term "suite" applies to both rental and ownership tenure. In a condominium, for example, dwelling units are considered separate suites. The term "suite" is not applied to service rooms, common laundry rooms and common recreational rooms that are not leased or under a separate tenure. Similarly, the term "suite" is not normally applied in schools and hospitals, since the entire building is under a single tenure. A rented room in a home for the aged could be considered a suite if the room were under a separate tenure. A hospital bedroom is not considered to be under a separate tenure, since the patient has little control of that space, even through the hospital is paid a per diem rate for the privilege of using the hospital facilities, which include the sleeping areas. In a hospital, while groups of rooms may function as a unit (e.g. maternity wards or intensive car units), they are not suites in the NBC 2005 sense, since they are not under separate management or control."

Unprotected opening
Unprotected opening means, when applied to an exposing building face, a doorway, window or opening other than one equipped with a closure having the required fire-protection rating, or any part of a wall forming part of the exposing building face that has a fire-resistance rating less than required for the exposing building face.

STOP

4.3 DETERMINING BUILDING HEIGHT (Subsection 3.2.1.)

Building Code Article 3.2.1.1. "Exceptions in Determining Building Height" identifies configurations by which 'building height' is influenced. This includes the presence of elements such as mezzanines, mechanical rooftop enclosures, services spaces, elevated walkways and platforms.

'Building height' is a defined term meaning ". . . the number of storeys contained between the roof and the floor of the first storey".

The determination of what constitutes the 'first storey' is influenced by the 'grade' around the perimeter of the building. Consider the following definitions from Section 4.2. of Module 4,"Definitions":

First storey: The *storey* with its floor closest to grade and its ceiling more than 1.8 m above grade.

Grade: The average level of proposed finished ground adjoining a building at all exterior walls.

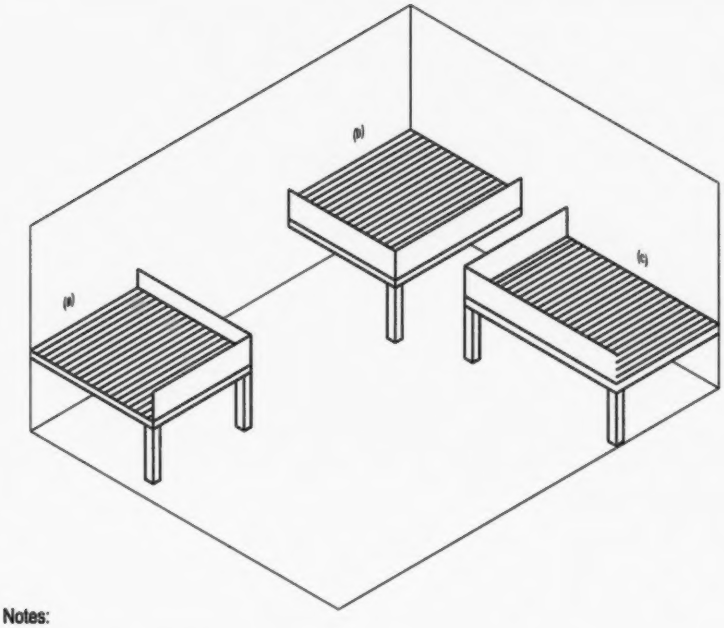
Table 4-1 consolidates the conditions wherein the noted element (i.e. service space, mezzanine) need not be considered as a storey in determining the building height.

TABLE 4-1

Exceptions in Determining Building Height			
Element	**Criteria for Exemption as a Storey**	**Code Reference**	**Notes**
Rooftop Enclosure	1. Contains either elevator machinery, stairway or service room used for no other purpose than servicing the building.	Sentence 3.2.1.1.(1)	N/A
Space below seating tiers	1. Arena type buildings only, provided the space must be used only for dressing rooms, concession stands and similar purposes incidental to the major occupancy of the building.	Sentence 3.2.1.1.(2)	- see Figure 4-2
40% (Open) Mezzanine	1. Aggregate area of the mezzanine floor is not greater than 40% of the open area of the room in which it is located, it is used as an open floor area [(1),(2)] and visual obstructions greater than 1070 mm above the mezzanine floor are not permitted.	Sentence 3.2.1.1.(3)	(1) Except in libraries, subject to meeting the requirements of Sentence 3.3.2.11.(3). - see Figure 4-4 (a) and (b) - see Figure 4-5 (2) Except an open mezzanine is permitted a maximum of 10% enclosed area provided visual communication is maintained Sentence 3.2.1.1.(8)
10% (Enclosed) Mezzanine	1. Aggregate area of the mezzanine floor is not greater than 10% of the floor area in which it is located.	Sentence 3.2.1.1.(4)	- Appendix A-3.2.1.1.(3)(a) - see Figure 4-3 (a) and (b)
Multiple Mezzanines	If one or more mezzanines are positioned above another, in whole or in part, each subsequent level to the first mezzanine level is considered as a storey.	Sentence 3.2.1.1.(5)	- see Figure 4-6 - except if permitted by 3.2.1.1.(6) & (7)

Exceptions in Determining Building Height			
Element	**Criteria for Exemption as a Storey**	**Code Reference**	**Notes**
Service Spaces	1. Services spaces for building services are exempted provided they conform with: a. Articles 3.2.5.15. and 3.3.1.23. b. Sentences 3.2.4.19.(12), 3.2.7.3.(2), 3.3.1.3.(7), 3.4.2.4.(3) and 3.4.4.4.(9).	Sentence 3.2.1.1.(9)	- OBC Appendix A-3.2.1.1.(9)
Mezzanines, walkways, platforms in Group F, Division 2 or 3 major occupancies	1. The building must be of noncombustible construction. 2. If they are intended to be occupied, the occupant load must not exceed 4 persons.	Sentence 3.2.1.1.(7)	N/A
Platforms intended solely for periodic inspection and elevated catwalks	1. They are not used for storage. 2. Noncombustible construction unless the building is permitted to be of combustible construction. 3. If they are intended to be occupied, the occupant load must not exceed 4 persons.	3.2.1.1.(6)	N/A

Aggregate Area of Mezzanine (At Same Level)



Notes:

1. Aggregate area= (a)+(b)+(c) of mezzanine.

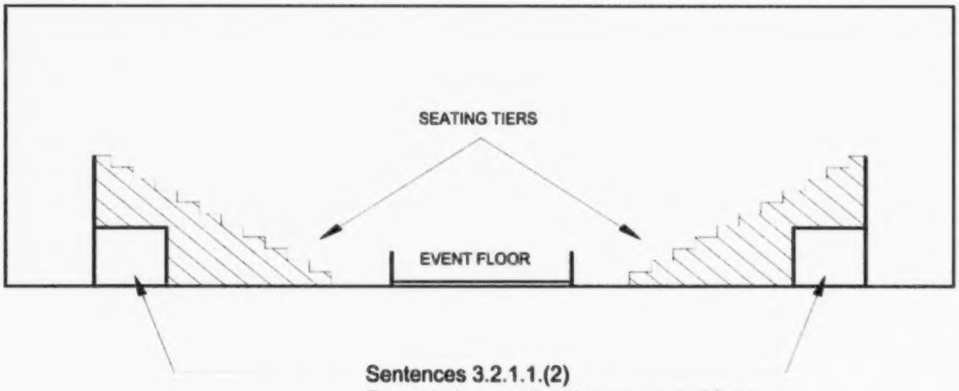
2. Expressed as a % of:

   a) the open area of the room in which it is located (Clause 3.2.1.1.(3)(a)) for 40% (open) mezzanine, or

   b) the floor area in which it is located (Clause 3.2.1.1.(4)(a)) for 10% (enclosed) mezzanine, and the suite in which it is located (Clause 3.2.1.1.(4)(b)) for 10% (enclosed) mezzanine.

FIGURE 4-1

Seating Tiers in Arenas



Sentences 3.2.1.1.(2)
Space below seating tiers exempted from classification as a storey provided space is used for only:
- Dressing rooms
- Concession stands
- Similar purposes incidental to major occupancy of the building.

FIGURE 4-2

10% (Enclosed) Mezzanine

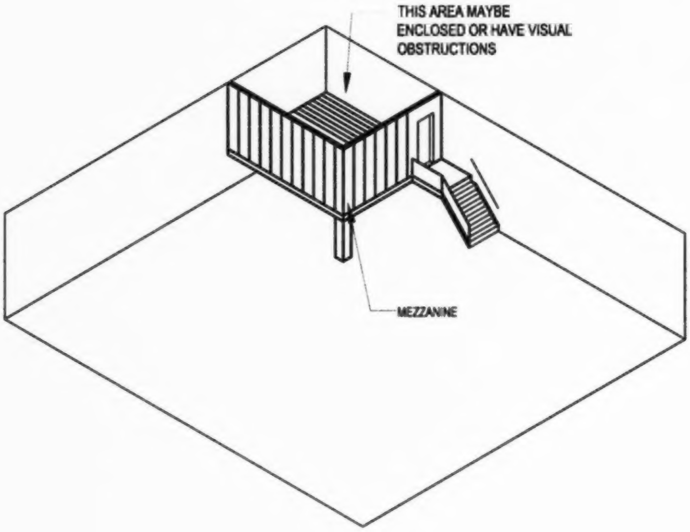
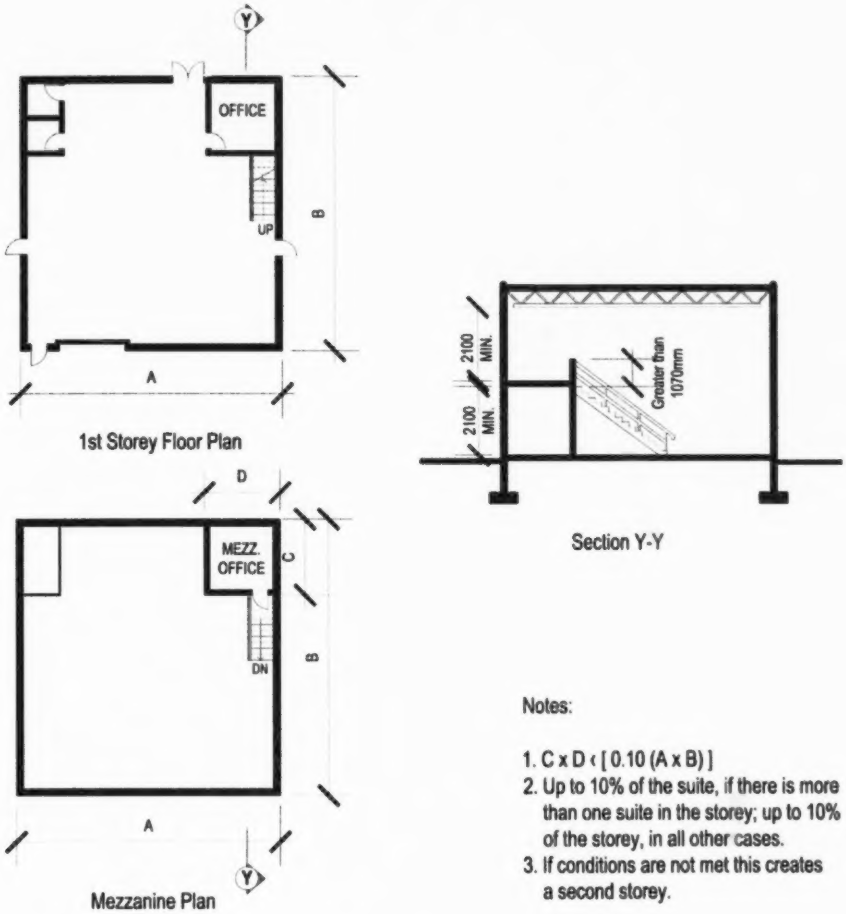

THIS AREA MAYBE ENCLOSED OR HAVE VISUAL OBSTRUCTIONS
MEZZANINE

FIGURE 4-3 (a)

10% (Enclosed) Mezzanine


Y
OFFICE
UP
B
A
D
MEZZ. OFFICE
C
DN
B
A
Y
2100 MIN.
2100 MIN.
Greater than 1070mm

1st Storey Floor Plan

Mezzanine Plan

Section Y-Y

Notes:

1. $C \times D < [\,0.10\,(A \times B)\,]$
2. Up to 10% of the suite, if there is more than one suite in the storey; up to 10% of the storey, in all other cases.
3. If conditions are not met this creates a second storey.

FIGURE 4-3 (b)

40% (Open) Mezzanine

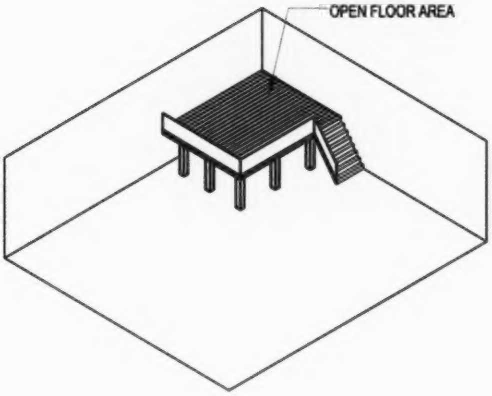
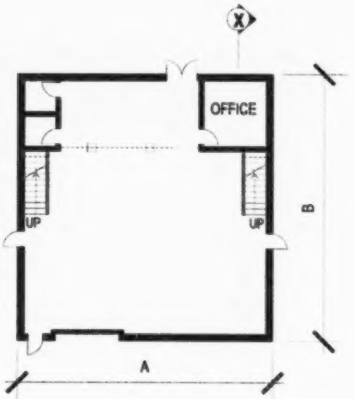
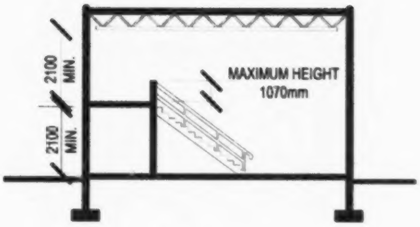

OPEN FLOOR AREA

FIGURE 4-4 (a)

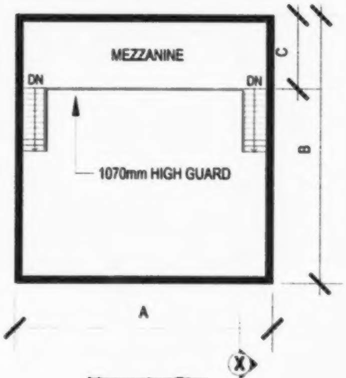
40% (Open) Mezzanine


X
OFFICE
UP
UP
B
A

1st Storey Floor Plan


2100 MIN.
2100 MIN.
MAXIMUM HEIGHT 1070mm

Section X-X


MEZZANINE
DN
DN
C
B
1070mm HIGH GUARD
A
X

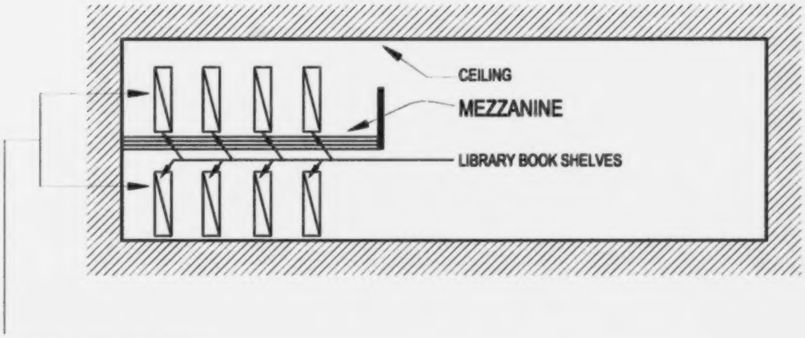
Mezzanine Plan

Notes:

1. $A \times C \leq [\, 0.4(A \times B) - \text{Office Area} - \text{W/C Areas} \,]$
2. Used as an open floor area.
3. Visual obstructions higher than 1070mm above mezzanine floor are not permitted except in libraries as permitted by Sentence 3.3.2.11.(3).
4. Up to 40% of the open area of the "room or suite" (Clause 3.2.1.1.(3)(a)).
5. If conditions are not met this creates a second storey.

FIGURE 4-4 (b)

Library Bookshelves on a Mezzanine

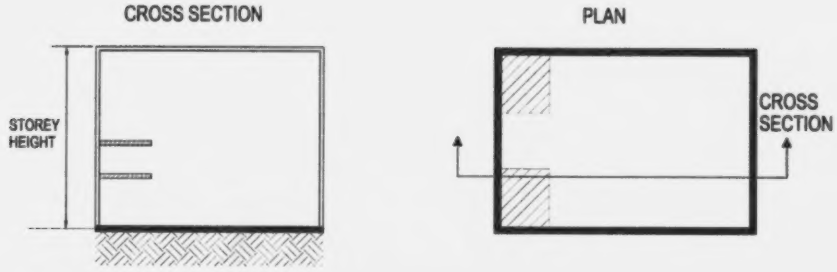

CEILING
MEZZANINE
LIBRARY BOOK SHELVES

Maximum Height of Bookshelves:

Up to 2100 mm but not more than 75% of the floor-to-ceiling height above or below the mezzanine.

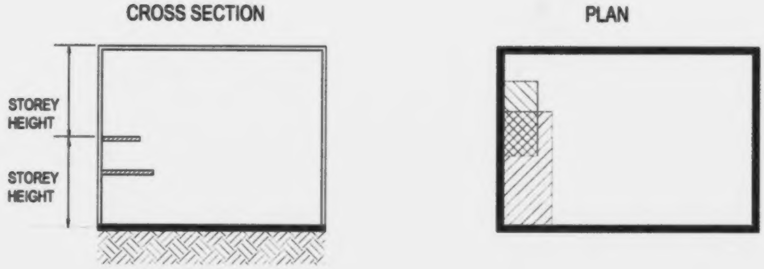
FIGURE 4-5

Multiple Mezzanines


CROSS SECTION
PLAN
STOREY HEIGHT
CROSS SECTION

Multiple mezzanines must be considered as storeys if they are located above one another, either in whole or in part (Sentence 3.2.1.1.(5)).

The mezzanines shown in Figure 4-6(a) above are not superimposed.


CROSS SECTION
PLAN
STOREY HEIGHT
STOREY HEIGHT

The mezzanines shown above are partially superimposed. Therefore, the mezzanine level above the first mezzanine is considered a storey.

FIGURE 4-6

EXERCISE #4-1

1. Select the correct condition under which visual obstructions above 1,070 mm in height are permitted on a 40% (open) mezzanine.

   a) 40% (open) mezzanine, Group D office occupancy with filing cabinets at 1,080 mm above the mezzanine floor.

   b) 40% (open) mezzanine, Group A, Division 1 occupancy with viewing screen at 2,100 mm in height above the mezzanine floor.

   c) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,000 mm above the mezzanine floor and 80% of the floor-to-ceiling height of the space above the floor assembly.

   d) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,100 mm above the floor of the mezzanine and 70% of the floor-to-ceiling height of the space above the mezzanine floor assembly.

____

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______________________________ [ ]

2. Review Figure 4-7. Does the proposed configuration of proposed mezzanines satisfy the exemption for storeys? Provide support, with Code references, for your answer.

____

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________________________________ [__________]

3. In a building of Group C (residential) major occupancy, a laundry room for the use of building occupants is located within the rooftop enclosure. The laundry room comprises 15% of the area of the rooftop enclosure. Must the rooftop enclosure be considered as a storey? Select the most correct answer from the options below.

    a) No, this rooftop occupancy is not required to be considered as a storey.

    b) Yes, the rooftop laundry room must be considered as a storey because it comprises more than 10% of the area of the roof on which it is located.

    c) Yes, the rooftop laundry room must be considered as a storey as it is not a service room.

    d) No, this rooftop enclosure is not required to be considered as a storey because it is only for building occupants.

____

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____________________[__________]

4. Review Figure 4-8. Which, if any, of the mezzanines must be considered as storeys? If they are indeed storeys, how many additional storeys do the mezzanines contribute?

____

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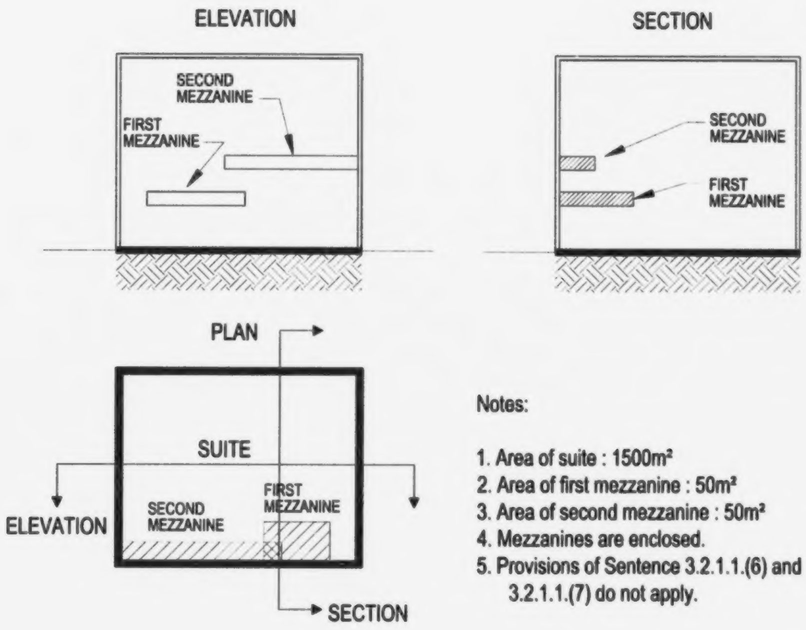
____

____

____________________[__________]

STOP

Mezzanines

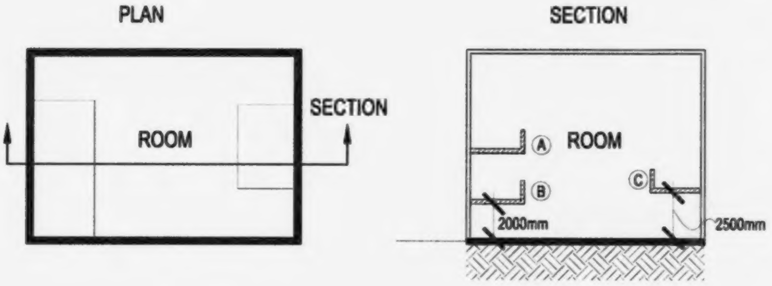

ELEVATION
SECOND MEZZANINE
FIRST MEZZANINE
SECTION
SECOND MEZZANINE
FIRST MEZZANINE
PLAN
SUITE
FIRST MEZZANINE
SECOND MEZZANINE
ELEVATION
SECTION

Notes:

1. Area of suite : 1500m²
2. Area of first mezzanine : 50m²
3. Area of second mezzanine : 50m²
4. Mezzanines are enclosed.
5. Provisions of Sentence 3.2.1.1.(6) and 3.2.1.1.(7) do not apply.

FIGURE 4-7

Mezzanines


PLAN
SECTION
ROOM
SECTION
Ⓐ
ROOM
Ⓑ
Ⓒ
2000mm
2500mm

Notes:

1. Mezzanine Ⓐ 14% of the open area of the room.
2. Mezzanine Ⓑ 14% of the open area of the room.
3. Mezzanine Ⓒ 11% of the open area of the room
4. All mezzanines are open (i.e. no visual obstruction above 1070mm from the mezzanine floor).

FIGURE 4-8

4.4 STORAGE GARAGE CONSIDERED A SEPARATE BUILDING

The Large Buildings - 2006 course reviews the requirements of Article 3.2.1.2.

4.5 SUBSECTION 3.2.2. "BUILDING SIZE AND CONSTRUCTION RELATIVE TO OCCUPANCY"

Building Code Subsection 3.2.2. establishes the primary construction requirements for buildings. This includes determination of permitted construction type (i.e. combustible or noncombustible) and fire-resistance ratings of assemblies and their structural supports.

The purpose of the requirements contained within this Subsection of the Building Code is to provide life safety and property protection by preventing fire spread and reducing the probability of collapse due to the effects of fire.

Subsection 3.2.2. comprises two general components. First, this Subsection describes the application of the requirements contained therein and specific rules/exemptions that apply in certain circumstances. These are contained in Article 3.2.2.2. through Article 3.2.2.19. (Article 3.2.2.1. is applicable to all buildings).

A summary of these Articles is provided in Table 4-2. This table provides only summary information on the respective regulations and should not be used for the purposes of Building Code application or interpretation.

The second component of Subsection 3.2.2. contains construction classification requirements. A summary of the construction classification size limits, per major occupancy, is provided in Table 4-3. These requirements set out the parameters for building construction type and structural fire-resistance requirements.

The determination of such requirements is based on the major occupancy classification of the building and is influenced by factors such as those summarized in Table 4-2.

Further explanatory material is included in the Large Buildings course.

Objectives

- Identify building height and building area.
- Determine the effect of multiple and superimposed major occupancies on construction classification.
- Identify the number of streets that serve a building.
- Determine structural fire-resistance ratings for storeys below ground.
- Describe the process of selecting the appropriate construction classification.

STOP

TABLE 4-2

ARTICLES 3.2.2.2. THROUGH 3.2.2.19		
Article	**Title**	**Description**
3.2.2.2.	Special and Unusual Structures	Addresses buildings which cannot be categorized in a building classification within Articles 3.2.2.20. to 3.2.2.83.
3.2.2.3.	Exceptions to Structural Fire Protection	Identifies structural members which are exempted from requiring fire protection.
3.2.2.4.	Buildings with Multiple Major Occupancies	States that building height and area are applied in determining construction requirements. If multiple major occupancies are present, this Article mandates the application of Articles 3.2.2.5. through 3.2.2.8.
3.2.2.5.	Applicable Building Height and Area	For a building containing multiple major occupancies, the building height and building area of the entire building must be applied.
3.2.2.6.	Multiple Major Occupancies	Except for "superimposed" major occupancies (and those waived in Article 3.2.2.8.) the most conservative construction classification requirements must be applied when a building contains multiple major occupancies.
3.2.2.7.	Superimposed Major Occupancies	The construction classification of each major occupancy must be assessed as though the entire building were of that occupancy (except those waived in Article 3.2.2.8.) The fire-resistance rating required for the floor separating superimposed major occupancies is based on the ratings required for the lower major occupancy.
3.2.2.8.	Exceptions for Major Occupancies	- Major occupancy designation is waived if the total area of the occupancy within a floor area of the storey is not more than10%. - The exception does not apply to Group F, Division 1 or 2 occupancies. - Rooftop helicopter landing pads are not considered major occupancies provided they do not exceed 10% of the area of the roof.
3.2.2.9.	Crawl Spaces	Regulates crawl spaces relative to whether they must be considered as basements.

3.2.2.10.	Streets	Identifies the criteria for determining the number of streets serving a building.
3.2.2.11.	Exterior Balconies	Exterior balconies must be of the same construction type as required for the occupancy classification of the building.
3.2.2.12.	Exterior Passageways	Elevated exterior passageways forming part of the means of egress must meet the construction requirements for mezzanines.
3.2.2.13.	Occupancy of Roof	The portion of a roof supporting an occupancy must be constructed with the same fire separation requirements for floor assemblies required in Articles 3.2.2.20 to 3.2.2.83.
3.2.2.14.	Roof-Top Enclosures	Regulates the type of construction of roof-top enclosures.
3.2.2.15.	Storeys below Ground	Regulates the fire-resistance ratings required for floor assemblies forming part of storeys below grade.
3.2.2.16.	Heavy Timber Roof Permitted	Provides permission for use of heavy timber construction for a roof, under certain circumstances.
3.2.2.17.	Sprinklers in Lieu of Roof Rating	Permits the waiver of roof rating requirements of Articles 3.2.2.20. through 3.2.2.83. provided the criteria of Sentence 3.2.2.17.(1) are met.
3.2.2.18.	Automatic Sprinkler System Required	Sprinkler systems required by Articles 3.2.2.20. though 3.2.283. must meet the requirements of Articles 3.2.4.7. through 3.2.4.9. and Article 3.2.5.13.
3.2.2.19.	Buildings Containing Impeded Egress Zones	Permits the waiver of Articles 3.2.2.36. and 3.2.2.37. for buildings containing impeded egress zones under specific conditions.

Articles 3.2.2.20. through 3.2.2.83. contain construction classification requirements based on major occupancy classification.

Table 4-3 of Module 4 provides summary information on the general organization of the construction classification requirements.

TABLE 4-3

FORMAT OF ARTICLES 3.2.2.20. THROUGH 3.2.2.83.			
Size	**Building Type**	**Reference**	**Size Limits**
Large	Group A, Division 1	3.2.2.20.	Any height, any area, sprinklered
↓		3.2.2.21.	1 storey, limited area
Smaller		3.2.2.22.	1 storey
Large	Group A, Division 2	3.2.2.23.	Any height, any area, sprinklered
↓		3.2.2.24.	up to 6 storeys, any area, sprinklered
		3.2.2.25.	Up to 2 storeys
		3.2.2.26.	up to 2 storeys, increased area, sprinklered
			up to 2 storeys, sprinklered
		3.2.2.27.	1 storey
Smaller		3.2.2.28.	
Large	Group A, Division 3	3.2.2.29.	Any height, any area (if Subsection 3.2.6., sprinklered)
↓		3.2.2.30.	Up to 2 storeys
		3.2.2.31.	Up to 2 storeys, sprinklered
		3.2.2.32.	1 storey, increased area
		3.2.2.33.	1 storey, sprinklered
		3.2.2.34.	1 storey
Smaller	Group A, Division 4	3.2.2.35.	1 storey - all buildings, sprinkler in all spaces below seats used for occupancy
Large	Group B, Division 1	3.2.2.36.	Any height, any area, sprinklered
↓		3.2.2.37.	Up to 3 storeys, sprinklered
	Group B, Division 2	3.2.2.38.	Any height, any area, sprinklered
	Group B, Division 3	3.2.2.39.	Up to 3 storeys, sprinklered
		3.2.2.40.	Up to 2 storeys, sprinklered
Smaller		3.2.2.41.	One storey, sprinklered
Large	Group C	3.2.2.42.	Any height, any area, sprinklered
↓		3.2.2.43.	Up to 6 storeys, sprinklered
		3.2.2.44.	Up to 4 storeys, noncombustible construction
		3.2.2.45.	Up to 4 storeys, sprinklered
		3.2.2.46.	Up to 3 storeys, increased area
		3.2.2.47.	Up to 3 storeys
Smaller		3.2.2.48.	Up to 3 storeys, sprinklered

Large	Group D	3.2.2.49.	Any height, any area (if under Subsection 3.2.6., sprinklered)
		3.2.2.50.	Up to 6 storeys
		3.2.2.51.	Up to 6 storeys, sprinklered
		3.2.2.52.	Up to 4 storeys, sprinklered
		3.2.2.53.	Up to 3 storeys
		3.2.2.54.	Up to 3 storeys, sprinklered
		3.2.2.55.	Up to 2 storeys
Smaller		3.2.2.56.	Up to 2 storeys, sprinklered
Large	Group E	3.2.2.57.	Any height, any area, sprinklered
		3.2.2.58.	Up to 4 storeys, sprinklered
		3.2.2.59.	Up to 3 storeys
		3.2.2.60.	Up to 3 storeys, sprinklered
		3.2.2.61.	Up to 2 storeys
Smaller		3.2.2.62.	Up to 2 storeys, sprinklered
Large	Group F, Division 1	3.2.2.63.	Up to 4 storeys, sprinklered
		3.2.2.64.	Up to 3 storeys, sprinklered
		3.2.2.65.	Up to 2 storeys, sprinklered
Smaller		3.2.2.66.	1 storey
Large	Group F, Division 2	3.2.2.67.	Any height, any area, sprinklered
		3.2.2.68.	Up to 6 storeys
		3.2.2.69.	Up to 4 storeys, increased area
		3.2.2.70.	Up to 4 storeys
		3.2.2.71.	Up to 2 storeys
Smaller		3.2.2.72.	Up to 2 storeys, sprinklered
Large	Group F, Division 3	3.2.2.73.	Any height, any area (if under Subsection 3.2.6., sprinklered)
		3.2.2.74.	Up to 6 storeys
		3.2.2.75.	Up to 6 storeys, sprinklered
		3.2.2.76.	Up to 4 storeys
		3.2.2.77.	Up to 4 storeys, sprinklered
		3.2.2.78.	Up to 2 storeys
		3.2.2.79.	Up to 2 storeys, sprinklered
		3.2.2.80.	1 storey
		3.2.2.81.	1storey, sprinklered
		3.2.2.82.	1 storey, any area, low fire load
Smaller		3.2.2.83.	Storage garages, up to 22 m high

The Large Buildings - 2006 course includes an exercise based on Tables 4-2, 4-3 and the relevant Code Articles.

4.6 DETERMINING CONSTRUCTION CLASSIFICATION

The process of determining the construction classification of a building has four steps. This can best be summarized as noted in Table 4-4. The Large Buildings - 2006 Course provides additional explanatory information.

TABLE 4-4

DETERMINATION OF CONSTRUCTION CLASSIFICATION

Step	Action	Description	Considerations
1	Review preliminary building information	Determine from drawings (or other information provided): 1. Major occupancy classification(s) 2. Building height 3. Building area 4. Provision of sprinkler protection 5. Number of streets	1. Apply the requirements of Articles 3.2.2.4. through 3.2.2.8. as necessary for multiple occupancies. See Table 4-5 for additional information. 2. Grade level around the building; determination of the location of the first storey 3. Presence of firewalls, i.e. as it affects building area.
2	Determine construction classification	Based on the information obtained in Step #1, select the appropriate construction classification from Articles 3.2.2.20. through 3.2.2.83.	1. Consider the impact of multiple major occupancies. See Table 4-5.
3	List construction requirements	Contained within Articles 3.2.2.20. through 3.2.2.83. Sentence (2) of each Article will contain the applicable construction classification requirements. **Attention:** construction requirements within an Article may be dependent upon multiple factors (i.e. building height, building area, number of streets).	1. Subsequent Sentences may be provided, in addition to Sentence (2), which contain requirements applicable to the building. If provided, these Sentences must be applied, as appropriate, to the respective building.

4	Consider exceptions and special conditions	Apply Articles 3.2.2.2., 3.2.2.3., and 3.2.2.9. through 3.2.2.19. As appropriate.	

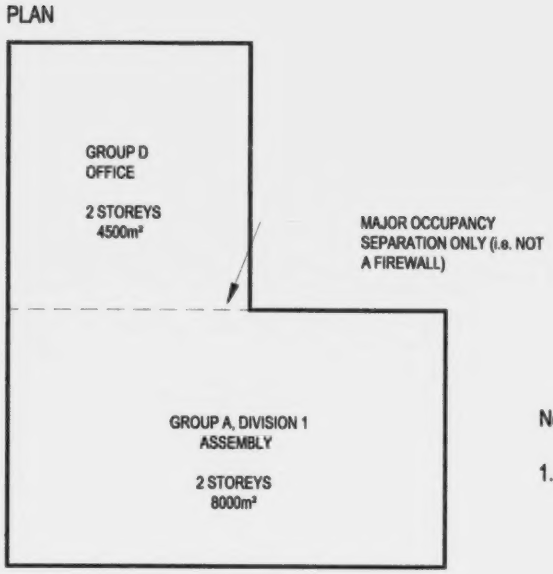
TABLE 4-5

APPLICATION OF ARTICLES 3.2.2.4 TO 3.2.2.8.

Occupancy Configuration	Aggregate area, as % of floor area within storey	Multiple Major Occupancy for Application of 3.2.2.20. to 3.2.2.83.	Outcome	References
Single Major Occupancy	N/A	No	- Apply Articles 3.2.2.20. to 3.2.2.83. as applicable based on building height and area	Sentence 3.2.2.4.(1)
Multiple Major Occupancies	>10% (or Group F, Div 1, Div 2 of any %)	Yes	- Apply 3.2.2.20. to 3.2.2.83. as applicable - Most restrictive requirements apply to whole building	Sentences 3.2.2.4.(2) 3.2.2.6.(1) 3.2.2.8.(1) Figure 4-9
	<10%	No	- Apply Articles 3.2.2.20. to .2.2.83. as applicable	Sentences 3.2.2.4(2) 3.2.2.8.(1)
Superimposed Major Occupancies	>10% (or Group F, Div1, 2 of any %; or, helipad >10% of roof area)	Yes	- Apply 3.2.2.20. to 3.2.2.83. as applicable - Apply each major occupancy as though the entire building was of that occupancy classification - Fire-resistance rating of floor assembly separating each major occupancy based on rating requirement of lower major occupancy	Sentence 3.2.2.4.(2) Articles 3.2.2.7. 3.2.2.8. Figure 4-10 Figure 4-11
	<10% (or helipad <10% of roof area)	No	- Apply 3.2.2.20. to 3.2.2.83. as applicable	Sentence 3.2.2.4.(2) Article 3.2.2.8.

The Large Buildings - 2006 course includes an additional Table which looks at Articles 3.2.2.4. to 3.2.2.8. individually.

Multiple Major Occupancies


PLAN
GROUP D
OFFICE
2 STOREYS
4500m²
MAJOR OCCUPANCY SEPARATION ONLY (i.e. NOT A FIREWALL)
GROUP A, DIVISION 1
ASSEMBLY
2 STOREYS
8000m²

Note:

1. Building faces 1 street.

Notes:

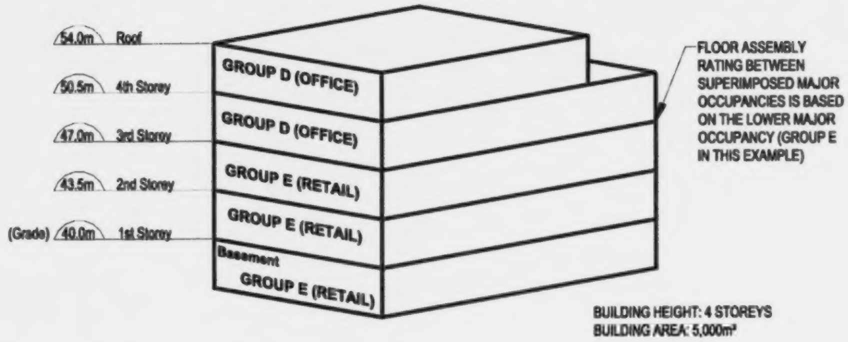
MAJOR OCCUPANCY	AREA (m^2)	BUILDING AREA (m^2)	BUILDING HEIGHT	BUILDING CLASSIFICATION (ARTICLE)	CONSTRUCTION TYPE	SPRINKLERS	FLOOR RATING (h)	MEZZANINE RATING (h)	RATING of SUPPORTING ELEMENTS (h)
GROUP D (OFFICE)	4500	12,500 (4500+ 8000)	2 STOREYS	3.2.2.51	NON-COMBUSTIBLE	REQUIRED	1	1	1
GROUP A DIVISION 1	8000			3.2.2.20	NON-COMBUSTIBLE	REQUIRED	2	1	1 or 2

Therefore, this building requires (3.2.2.6):

1. Noncombustible construction.
2. Sprinkler protection throughout.
3. Floor assemblies must be constructed as fire separations having a fire-resistance rating of 2 h.
4. Mezzanines must have a fire resistance rating of 1 h.
5. Loadbearing walls, columns and arches must have a fire-resistance rating not less than that of the supported assembly.
6. The major occupancy separation between the Group D and Group A, Division 1 major occupancies must be 1 h per Sentence 3.1.3.1.(1)

FIGURE 4-9

Superimposed Major Occupancies


54.0m Roof
50.5m 4th Storey
47.0m 3rd Storey
43.5m 2nd Storey
(Grade) 40.0m 1st Storey
GROUP D (OFFICE)
GROUP D (OFFICE)
GROUP E (RETAIL)
GROUP E (RETAIL)
Basement
GROUP E (RETAIL)
FLOOR ASSEMBLY RATING BETWEEN SUPERIMPOSED MAJOR OCCUPANCIES IS BASED ON THE LOWER MAJOR OCCUPANCY (GROUP E IN THIS EXAMPLE)
BUILDING HEIGHT: 4 STOREYS
BUILDING AREA: 5,000m²

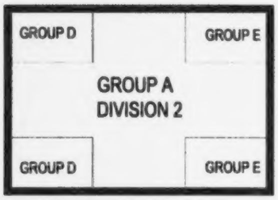
Notes:

1. Construction classification must be based on the building height and building area , per major occupancy. For the example above, assess as:
   a) 4 storey building of Group E major occupancy having a building area of 5,000m²; then as a
   b) 4 storey building of Group D major occupancy having a building area of 5,000m²

FIGURE 4-10

Exceptions for Major Occupancies

(a)

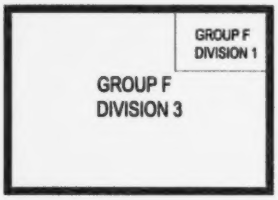

GROUP D
GROUP E
GROUP A
DIVISION 2
GROUP D
GROUP E

Notes:

1. Based on diagram (a):

   a) Primary occupancy- Group A, Division 2
   b) Other occupancies are major occupancies for application of Subsection 3.2.2 if:
   -Area of Group D > 10% of the storey, or
   -Area of Group E > 10% of the storey.

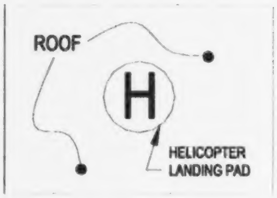
(b)


GROUP F
DIVISION 1
GROUP F
DIVISION 3

Note:

1. Group F, Division 1 or Division 2 occupancies of any area are considered major occupancies for the application of Subsection 3.2.2.

(c)


ROOF
H
HELICOPTER
LANDING PAD

Note:

1. Helicopter landing pad on a roof is not considered a major occupancy if it's area is < 10% of the area of the roof.

FIGURE 4-11

EXERCISE #4-2

Using the preceding information in combination with reference to the Building Code, as applicable, answer the following questions.

1. Consider the building shown in Figure 4-12 and determine the most appropriate construction classification Article.

    a) Article 3.2.2.56., Group D, up to 2 Storeys, Sprinklered

    b) Article 3.2.2.57., Group E, Any Height, Any Area, Sprinklered

    c) Article 3.2.2.60., Group E, up to 3 Storeys, Sprinklered

    d) Article 3.2.2.61., Group E, up to 2 Storeys

    ______________________ [____________]

2A. Consider Figure 4-13. Identify the most appropriate classification of building based on construction classification Article(s) applicable to the major occupancies in the building.

____

____

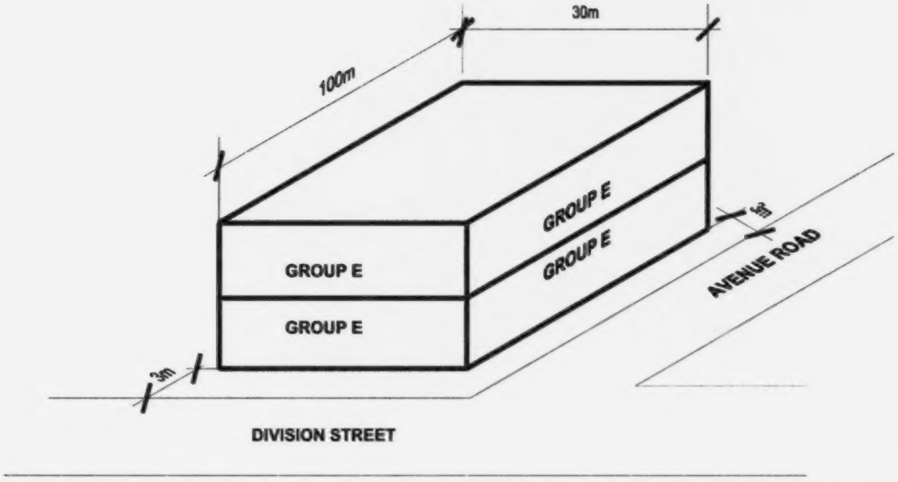
2B. What requirement would you apply?

____

____

3. Based on Subsection 3.2.2., identify the most appropriate construction classification Article(s) applicable to Figure 4-14. What fire-resistance rating is required between the major occupancies?

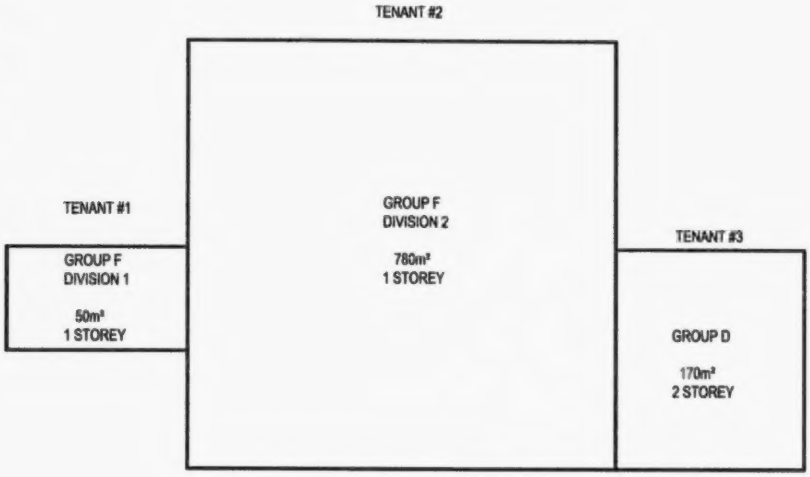
STOP


30m
100m
GROUP E
GROUP E
GROUP E
GROUP E
3m
3m
AVENUE ROAD
DIVISION STREET

Note:

1. The building is provided with sprinkler protection throughout.

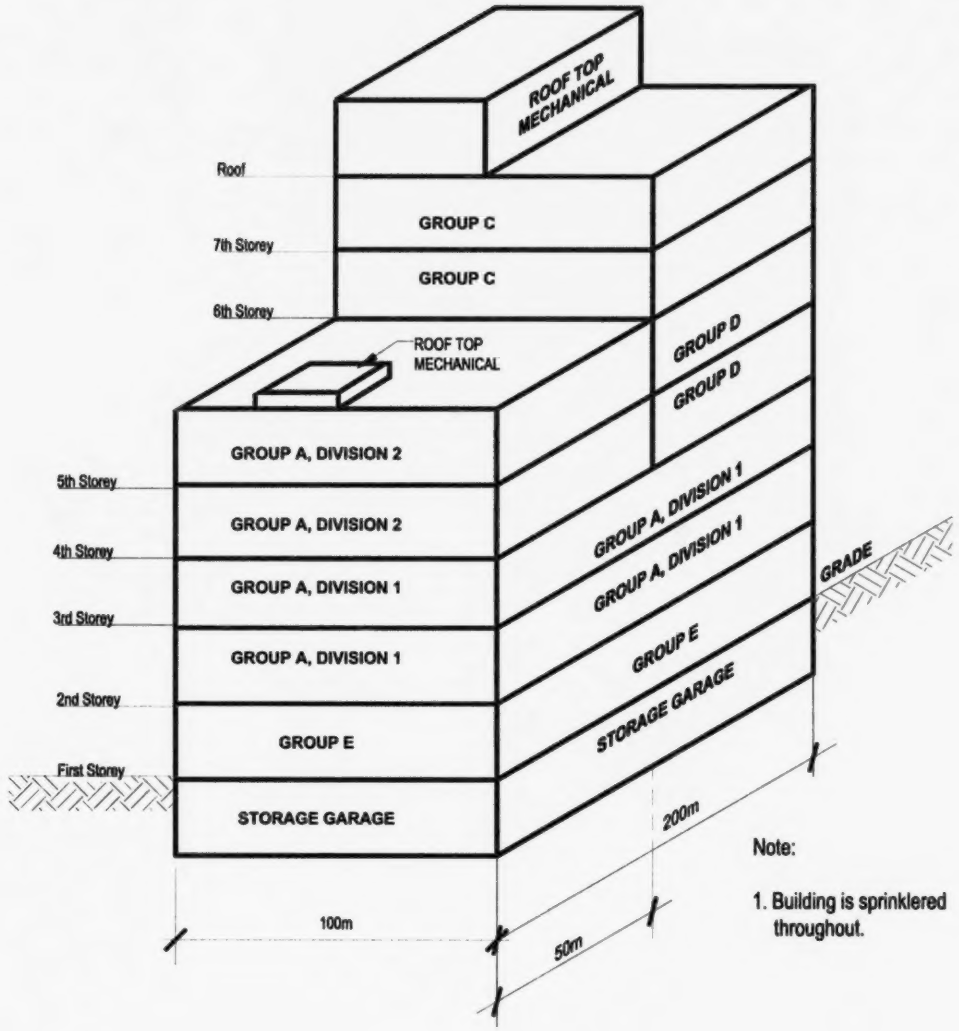
FIGURE 4-12


TENANT #2
TENANT #1
GROUP F
DIVISION 2
780m²
1 STOREY
TENANT #3
GROUP F
DIVISION 1
50m²
1 STOREY
GROUP D
170m²
2 STOREY

Note:

1. Building is sprinklered throughout.
2. Separations between major occupancies are not firewalls.

FIGURE 4-13


ROOF TOP MECHANICAL
Roof
GROUP C
7th Storey
GROUP C
6th Storey
ROOF TOP MECHANICAL
GROUP D
GROUP D
GROUP A, DIVISION 2
5th Storey
GROUP A, DIVISION 2
4th Storey
GROUP A, DIVISION 1
3rd Storey
GROUP A, DIVISION 1
2nd Storey
GROUP E
First Storey
STORAGE GARAGE
GROUP A, DIVISION 1
GROUP A, DIVISION 1
GROUP E
STORAGE GARAGE
GRADE
200m
100m
50m

Note:

1. Building is sprinklered throughout.

FIGURE 4-14

4.7 "SPATIAL SEPARATION AND EXPOSURE PROTECTION" (Subsection 3.2.3.)

The Large Buildings - 2006 course covers Subsection 3.2.3. in greater detail.

Unprotected Openings

An unprotected opening in an exposing building face (EBF) is generally characterized as a window or door opening, and includes any part of a wall forming part of the EBF that has a fire-resistance rating less than that required for the EBF.

Unprotected openings may be protected with closures. Wired glass or glass block are not considered as closures in an exterior wall.

Tables 3.2.3.1.A, B, C and D do not list all possible values for limiting distance and area of exposing building face. Intermediate values can be determined by interpolation.

Limiting Distance

Limiting distance is the distance from an exposing building face to a property line, the centre line of a street or public thoroughfare, or an assumed line between two buildings or two fire compartments on the same property.

Fire Exposure Between Fire Compartments

The intent of Articles 3.2.3.13. and 3.2.3.14. is to reduce the probability of the spread of fire from one fire compartment to an adjacent fire compartment in the same building through unprotected openings in the exterior wall of the fire compartment of origin.

Where two exposing building faces form an angle of 135º or less (in the case of parallel EBF's, the angle of intersection is 0°), there is a potential danger of fire spreading from one fire compartment to the other, if the walls contain openings or do not have sufficient fire-resistance. To reduce this risk, each exterior wall must be constructed with limits on the amount of unprotected openings and with a fire-resistance rating not less than that of the fire separation between the fire compartments and the rest of the building.

Except for openings in an exit facility exposed to openings from another fire compartment, this opening protection requirement is waived in sprinklered buildings [3.2.3.13. & 3.2.3.14.].

STOP

EXERCISE #4-3

Read Sentences 3.2.3.1.(1), (2), (4), (5), (6), and (7) and Article 3.2.3.2. and consider Figure 4-15.

1. Calculate the area of unprotected opening(s) permitted in the south exposing building face. The known values are as follows:

   - The limiting distance is 4.0 m.
   - Fire compartment 'A' is 50 m by 5 m at the EBF.
   - Fire compartment 'B' is 100 m by 5 m at the EBF.
   - The building is a Group D occupancy.
   - The building is not sprinklered.

The 1 h fire separation between the D occupancies permits the area of EBF to be calculated for each fire compartment - Sentence 3.2.3.2.(2).

____

____

____

___________________________[____________]

2. Read Sentence 3.2.3.1.(4). Review Figure 4-16 and state how you would determine the allowable percentage of unprotected openings when the limiting distance is not constant.

____

____

____

__________________________ [____________]

3. A sprinklered building having Group D and Group F Division 1 occupancies, has an exposed building face with the following characteristics.

   Group D occupancy has 30% maximum allowable unprotected openings Group F, Division 1 occupancy - 40% unprotected openings

   Describe the construction of the exposed building faces. The exposed building face has a limiting distance of 5.0 m to the property line.

____

____

____

____

____

__________________________ [____________]

4. An exit stair enclosure has an opening in the exterior wall. The enclosure forms an angle of 75º with the plane of the exterior wall of the building. The exterior wall of the building also has an opening located 10.5 m horizontally and 1 m above the opening in the exterior wall of the exit.

   Are the openings in the building or exit enclosure required to be protected?

   ____

   ____

   ____

   ____

   ____

   ____

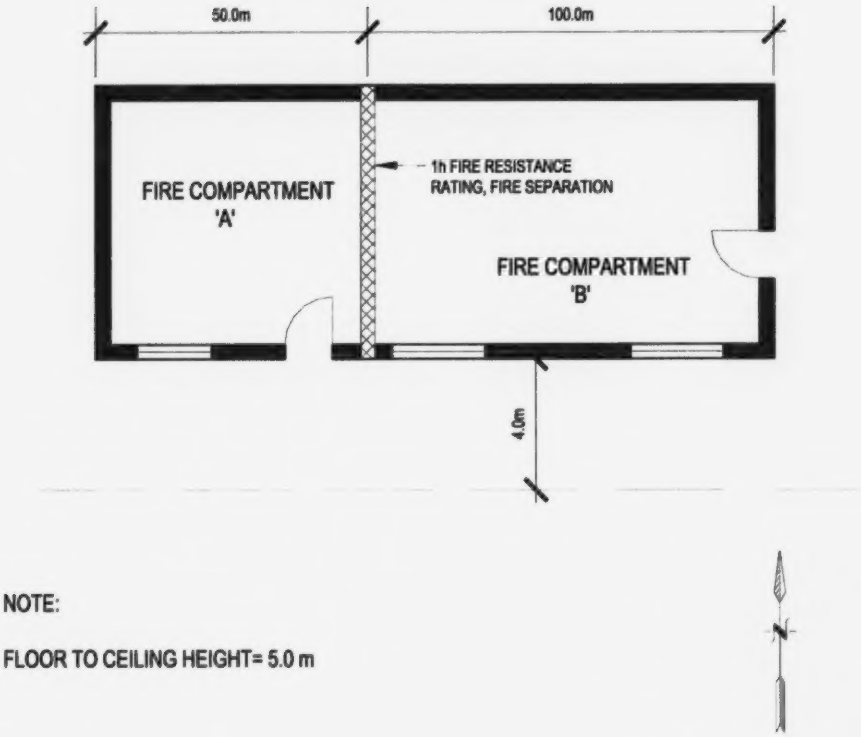
   ____

   ____

   ____

   ____________________ [   ]

STOP


50.0m
100.0m
FIRE COMPARTMENT 'A'
1h FIRE RESISTANCE RATING, FIRE SEPARATION
FIRE COMPARTMENT 'B'
4.0m
N

NOTE:

FLOOR TO CEILING HEIGHT= 5.0 m

FIGURE 4-15

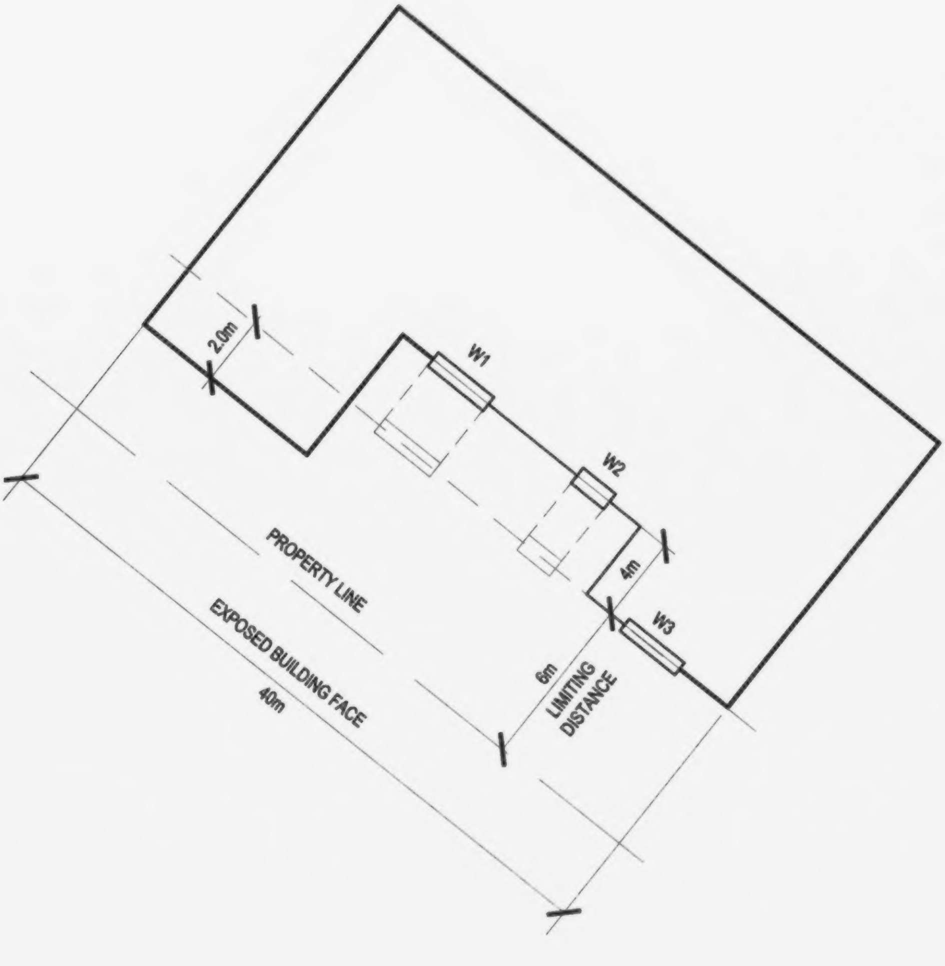

2.0m
W1
W2
4m
W3
PROPERTY LINE
EXPOSED BUILDING FACE
40m
6m
LIMITING DISTANCE

FIGURE 4-16

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Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 5

COMPLEX BUILDINGS - 2006

PROVISIONS FOR FIREFIGHTING

5.1 INTRODUCTION

This part of Building Fire Safety refers to active fire protection and life safety building systems, provisions for fire department access to a building, and interconnected floor spaces.

This module will concentrate on requirements in the Building Code for:

- fire department building access
- sprinkler systems
- lighting and emergency power systems
- standpipe systems

This module addresses Part 3 requirements, which are applicable to new buildings, new additions, and where required by Parts 10 and 11 regarding change of use and major renovations.

This module includes a list of defined terms relating to the content in this module. For a complete list of definitions, refer to Division A, Part 1 [1.4.1.2.].

Objectives

- Locate Code requirements for the above listed systems

- Describe the steps and the process of applying the Code requirements

- Demonstrate the procedure/method of applying the Code requirements to obtaining your answer

Upon completion of this module, you will be able to:

- Apply design criteria for fire department building access.
- Identify specific criteria in the Code that applies to sprinkler systems.
- Determine which buildings require a standpipe system and identify specific design criteria.

5.2 DEFINITIONS

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 [1.4.1.2.]. Defined terms are found throughout the Code and are identified in italics text. While defined terms are shown in italics in this section, they will not be shown in italics where used elsewhere in this module.

It is important to recognize that a defined term is an integral part of the requirement in which it is found. The defined term must be understood and applied within the context of the requirement.

Building height
Building height means the number of storeys contained between the roof and the floor of the first storey.

Service space
Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Sprinklered
Sprinklered means equipped with a system of automatic sprinklers.

Storage garage
Storage garage means a building or part of a building that is intended for the storage or parking of motor vehicles and that contains no provision for the repair or servicing of motor vehicles.

Storey

Storey means, except for the purpose of Part 7 of Division B, the portion of a building,

a) that is situated between the top of any floor and the top of the floor next above it, or
b) that is situated between the top of the floor and the ceiling above the floor, if there is no floor above it.

Street

Street means any highway, road, boulevard, square or other improved thoroughfare 9 m or more in width, which has been dedicated or deeded for public use, and that is accessible to fire department vehicles and equipment.

STOP

5.3 PROVISIONS FOR FIREFIGHTING GENERAL OVERVIEW
(Subsection 3.2.5.)

Subsection 3.2.5. "Provisions for Firefighting"

This Subsection provides requirements for designing means to allow firefighting apparatus and their crew to gain access to a building for the purpose of fighting a fire and for the rescue of building occupants.

The requirements in this Subsection are based on the assumption that firefighting capabilities are available to respond to the building in the event of a fire emergency. Appendix A in Volume 2, must be reviewed as a guideline for applying the requirements of Subsection 3.2.5., which also applies to other fire safety provisions in Part 3.

Article 3.2.5.1. "Access to Above Grade Storeys", Article 3.2.5.2. "Access to Basements", and Article 3.2.5.3. "Roof Access", provides requirements for access into the building by firefighters. Access is required to be by means of windows, access panels, or doors.

Direct exterior firefighting access is required to all above grade unsprinklered storeys, whose floor level is less than 25 m, from each building face that is required to face a street (refer to Figure 5-1) [3.2.5.1.(1)].

The number of building faces that are required to face a street are based on the construction requirements of Articles 3.2.2.20. through 3.2.2.83. Where the construction requirements in Articles 3.2.2.20. through 3.2.2.83. do not specify the number of streets a building is required to face, it is mandated by Sentence 3.2.2.10.(1) that a building face at least one street.

Sentence 3.2.2.10.(1) requires that every building face a street located in conformance with the requirements of Articles 3.2.5.5. and 3.2.5.6. Article 3.2.5.5. provides location requirements for the access route(s), while Article 3.2.5.6. provides design requirements for access route(s). In addition, when a building is more than 3 storeys in building height or more than 600 m^2 in building area, Sentence 3.2.5.4.(1) specifies that the principal entrance and each building face is required to have access openings for firefighters, and be located as per the requirements of Sentences 3.2.5.5.(1) and (2). If a building is divided into separate buildings by firewalls, each principal entrance would have to be located not less than 3 m and not more than 15 m from the access route, when each so divided building is either more than 3 storeys in building height or greater than 600 m^2 in building area.

When a building is not provided with a fire department connection, Clause 3.2.5.5.(2)(b) requires that, the fire department access route be located so that a fire department pumper vehicle can be located so that the length of the access route from a hydrant to the vehicle, plus the unobstructed path of travel for the firefighter from the vehicle to the building, is not more than 90 m. Clause 3.2.5.5.(2)(c) requires that, the unobstructed path of travel for the firefighter from the vehicle to the building, be not more than 45 m. Sentence 3.2.5.5.(3) provides clarity on how to measure the 45 m distance. If a portion of a building is completely cut off from the remainder of the building, so that there is no access to the remainder of the building, Sentence 3.2.5.5.(4) requires that the fire department access routes be located so that the unobstructed path of travel from the vehicle to one entrance of each portion of the building, is not more than 45 m.

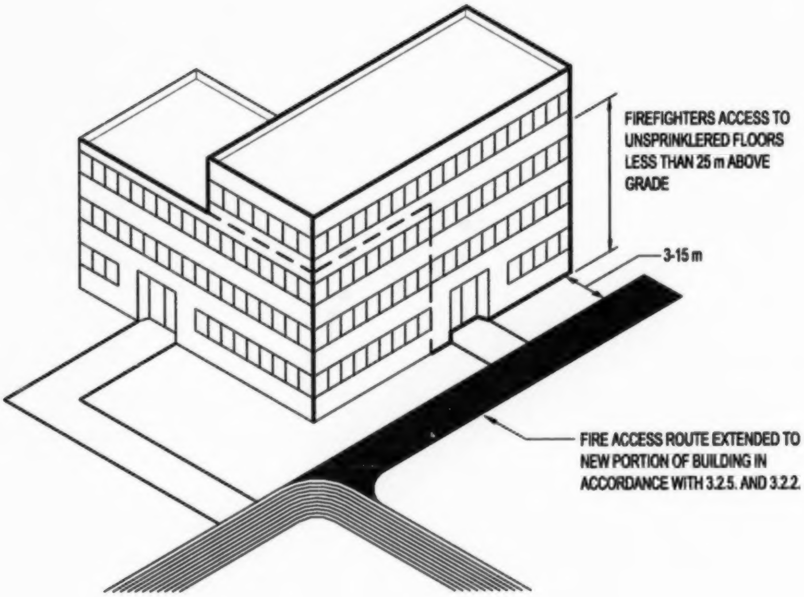

FIREFIGHTERS ACCESS TO UNSPRINKLERED FLOORS LESS THAN 25 m ABOVE GRADE
3-15 m
FIRE ACCESS ROUTE EXTENDED TO NEW PORTION OF BUILDING IN ACCORDANCE WITH 3.2.5. AND 3.2.2.

FIGURE 5-1

Direct firefighter access from the outside is required to each basement that is not sprinklered and that has a horizontal dimension greater than 25 m. The requirement does not apply to sprinklered basements (refer to Figure 5-2) [3.2.5.2.(1)].

In a sprinklered building, storeys above grade and basement levels are permitted to be accessed through a single building entrance.

Article 3.2.5.4. "Access Routes" requires buildings that exceed three storeys in building height, or exceed 600 m^2 in building area, to be provided with a fire access route to the principal entrance and to each building face of unsprinklered floor areas that are required to have direct exterior firefighter access required by Articles 3.2.5.1. and 3.2.5.2.

Where a building is required to face two or more streets, refer to Article 3.2.2.10. "Streets" to determine the percentage of the building perimeter that is required to face a street or streets. A building is considered to face two streets if not less than 50% of the building perimeter is located within 15 m of a street or streets. A building is considered to face three streets if not less than 75% of the building perimeter is located within 15 m of a street or streets. The building perimeter that is required to face a street(s) is required by Sentence 3.2.5.5.(1) to be located at least 3 m but not more than 15 m from the street(s) (refer to Figure 5-3).

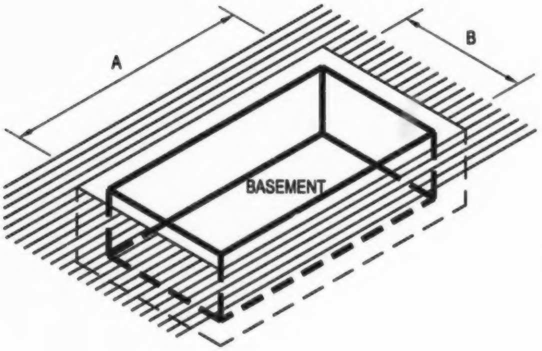
For the purpose of Article 3.2.2.10. requirements, a fire access route designed in compliance with Subsection 3.2.5. is considered a street.

Article 3.2.5.5., "Location of Access Routes" and Article 3.2.5.6., "Access Route Design" provide minimum dimensional design requirements for fire access routes.

- Article 3.2.5.5. outlines distance requirements between a fire route, fire department connections, building entrances, fire trucks and hydrants. Refer to Figure 5-4.

- Sentence 3.2.5.5.(4) applies to conditions where a portion of a building cannot be internally accessed from another part of the building. There may be multiple portions of the same building which are not accessible to each other from the interior. Refer to Figure 5-5. Such segregated portions of the building must be provided with an entrance that is within 45 m of unobstructed travel from the location of the fire vehicle on the access route, as required in Sentence 3.2.5.5.(2).

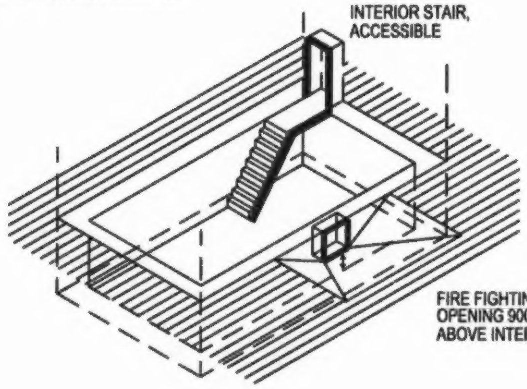
Article 3.2.5.2.



UNSPRINKLERED
BASEMENT

IF A OR B IS GREATER THAN 25m, DIRECT
OUSIDE ACCESS FOR FIRE FIGHTING IS
REQUIRED TO THE BASEMENT

TYPES OF ACCESS PERMITTED

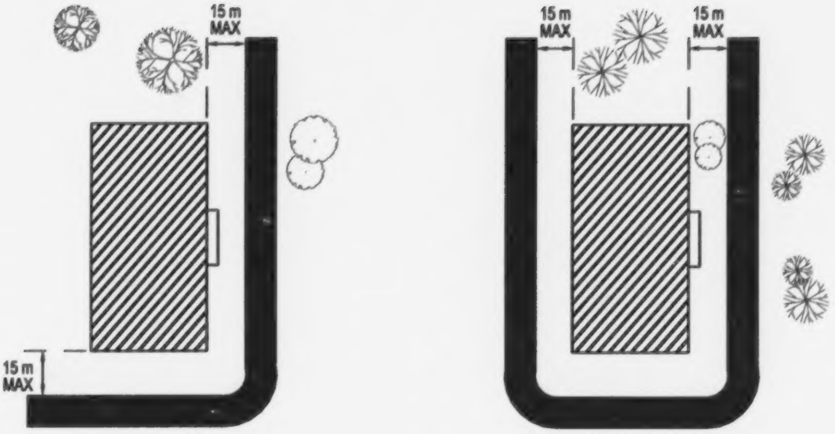


INTERIOR STAIR,
ACCESSIBLE

FIRE FIGHTING ACCESS [3.2.5.2.(2)(b)]
OPENING 900 mm
ABOVE INTERIOR FLOOR [3.2.5.2.(2)(a)]

FIGURE 5-2

Article 3.2.2.10.


15 m MAX
15 m MAX
15 m MAX
15 m MAX

FACING 2 STREETS
NOT LESS THAN
50% OF BUILDING
PERIMETER

FACING 3 STREETS
NOT LESS THAN
75% OF BUILDING
PERIMETER

FIGURE 5-3

Clauses 3.2.5.5.(2)(b) and (c)

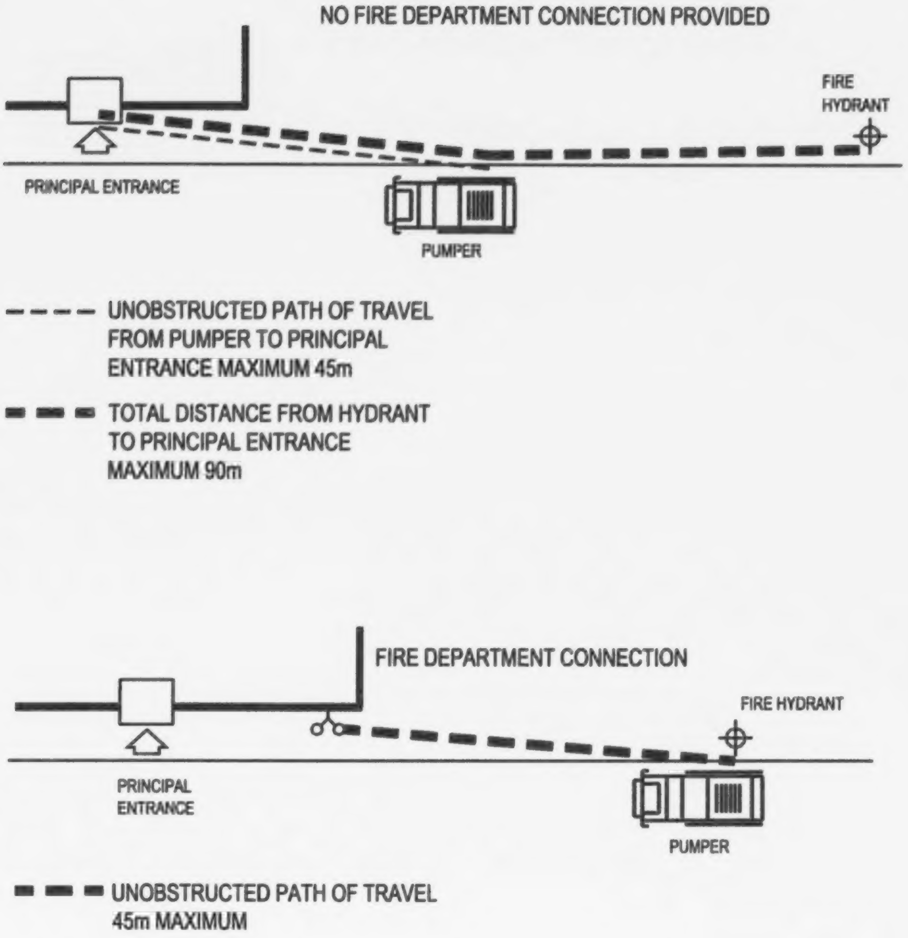

NO FIRE DEPARTMENT CONNECTION PROVIDED
FIRE HYDRANT
PRINCIPAL ENTRANCE
PUMPER
UNOBSTRUCTED PATH OF TRAVEL FROM PUMPER TO PRINCIPAL ENTRANCE MAXIMUM 45m
TOTAL DISTANCE FROM HYDRANT TO PRINCIPAL ENTRANCE MAXIMUM 90m
FIRE DEPARTMENT CONNECTION
FIRE HYDRANT
PRINCIPAL ENTRANCE
PUMPER
UNOBSTRUCTED PATH OF TRAVEL 45m MAXIMUM

FIGURE 5-4

Sentence 3.2.5.5.(4)

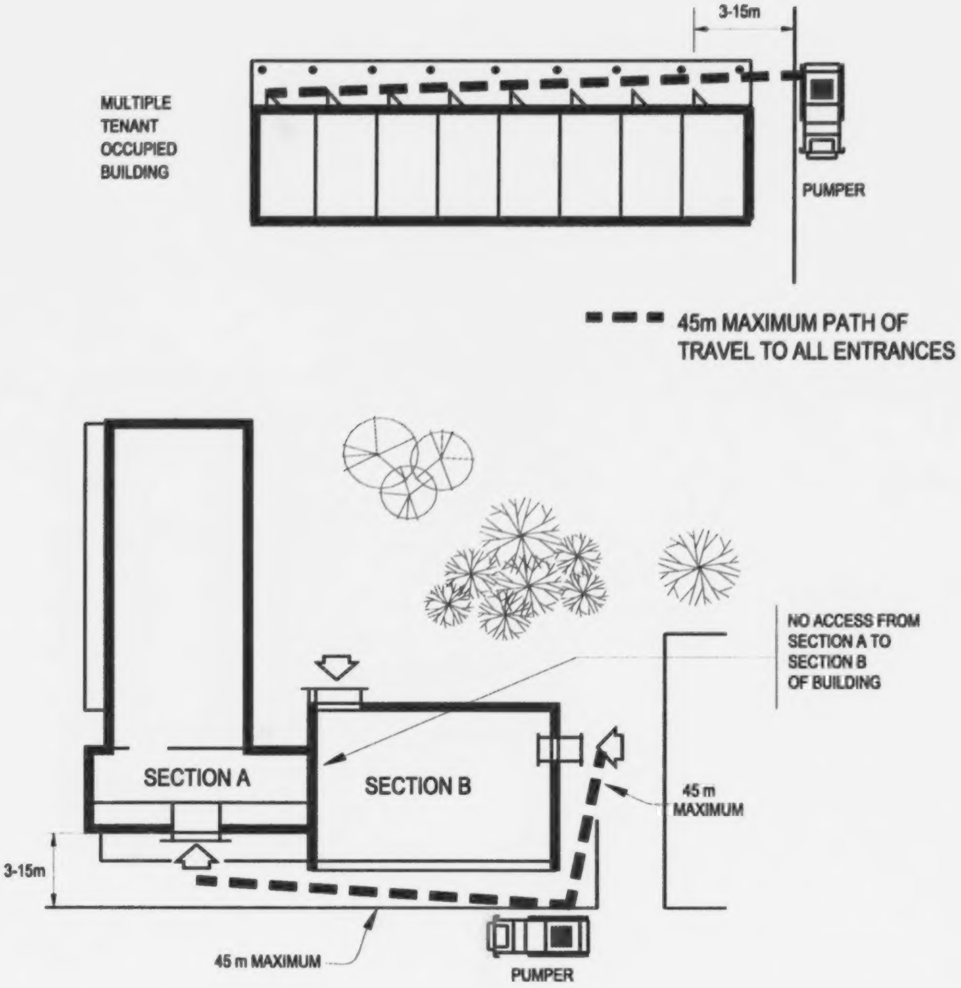

3-15m
MULTIPLE TENANT OCCUPIED BUILDING
PUMPER
45m MAXIMUM PATH OF TRAVEL TO ALL ENTRANCES
NO ACCESS FROM SECTION A TO SECTION B OF BUILDING
SECTION A
SECTION B
45 m MAXIMUM
3-15m
45 m MAXIMUM
PUMPER

FIGURE 5-5

- Article 3.2.5.6. "Access Route Design" outlines dimensional criteria of the fire route, such as minimum required width, maximum permitted centre line radius, slope, load capacity, turnaround facilities for dead-end segments and overhead clearances.

  Examples of dimensional criteria are illustrated in Figure 5-6 on the next page.

  As previously stated, buildings must face at least one street. The street(s) required to be faced is/are mandated by Sentence 3.2.2.10.(1) to comply with the fire access route design requirements of Articles 3.2.5.5. and 3.2.5.6.

STOP

Article 3.2.5.6.

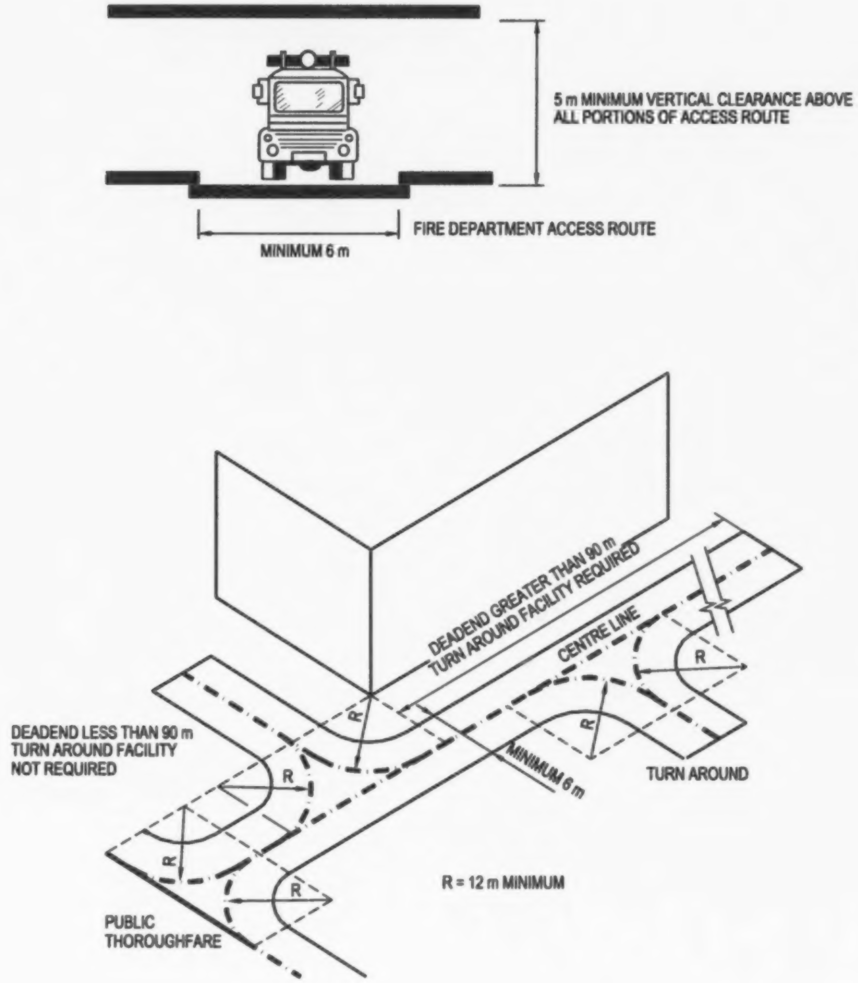

5 m MINIMUM VERTICAL CLEARANCE ABOVE
ALL PORTIONS OF ACCESS ROUTE
FIRE DEPARTMENT ACCESS ROUTE
MINIMUM 6 m
DEADEND GREATER THAN 90 m
TURN AROUND FACILITY REQUIRED
CENTRE LINE
R
DEADEND LESS THAN 90 m
TURN AROUND FACILITY
NOT REQUIRED
MINIMUM 6 m
TURN AROUND
R = 12 m MINIMUM
PUBLIC
THOROUGHFARE

FIGURE 5-6

EXERCISE #5-1

Take 10 minutes to familiarize yourself with Subsection 3.2.5.

Refer to Figure 5-7 and Articles 3.2.5.5. and 3.2.5.6. to complete the following exercise. Take 10 minutes.

The building in the illustration is 3 storeys in building height, Group C major occupancy (apartment building), is not sprinklered, is provided with a fire alarm system and has a building area of 2,300 m^2. The building is required to face one street.

1. State below, for each alphabet symbol found on Figure 5-7, the required dimension in compliance with Articles 3.2.5.5. and 3.2.5.6. Identify whether this requirement is 'maximum permitted' or 'minimum required', and the Code references to support your answer.

   a) ______________________________ [______________]

   b) ______________________________ [______________]

   c) ______________________________ [______________]

   d) ______________________________ [______________]

STOP

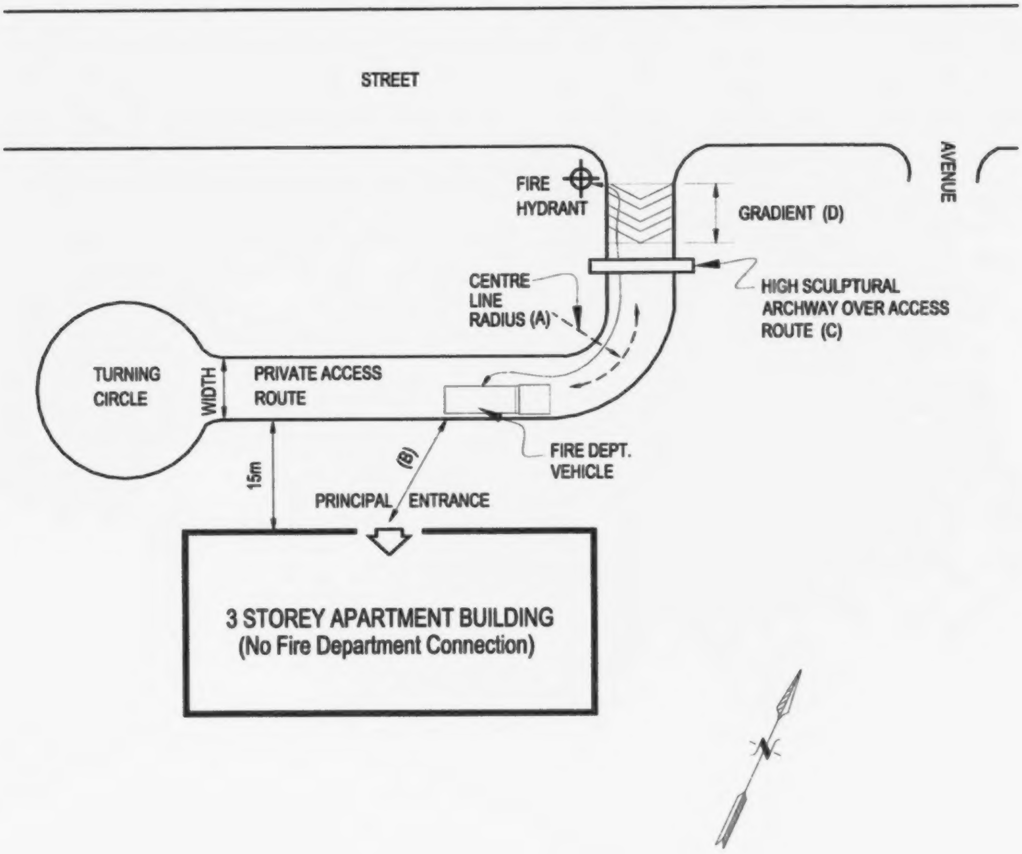

STREET
AVENUE
FIRE HYDRANT
GRADIENT (D)
CENTRE LINE RADIUS (A)
HIGH SCULPTURAL ARCHWAY OVER ACCESS ROUTE (C)
TURNING CIRCLE
WIDTH
PRIVATE ACCESS ROUTE
FIRE DEPT. VEHICLE
15m
(B)
PRINCIPAL ENTRANCE
3 STOREY APARTMENT BUILDING
(No Fire Department Connection)
N

FIGURE 5-7

Water Supply

Article 3.2.5.7. "Water Supply" requires an "adequate water supply for firefighting" to be provided for every building. Article 3.2.5.7. refers to A-3.2.5.7 in the Appendix for guidance in determining adequate water supply for firefighting purposes.

Sentence (2) requires that fire hydrants be located within 90 m, measured horizontally from the exterior wall, of any portion of the building perimeter that is required to face a street. For example, 50% of a building perimeter faces a street or streets, and is considered to face two streets; that 50% of the building perimeter is required to be within 90 m of a fire hydrant, measured horizontally from the building face.

Sprinkler Systems

This section of the module identifies sprinkler requirements not only in Subsection 3.2.5. but from other areas in Part 3 of the Code.

Article 3.2.5.13. "Automatic Sprinkler Systems", Article 3.2.5.14. "Combustible Sprinkler Piping", and Article 3.2.5.15. "Sprinklered Service Space" provide design and installation requirements for sprinkler systems.

In general, the above three Articles amend the requirements of NFPA 13, "Installation of Sprinkler Systems" requirements.

The eight Sentences under Article 3.2.5.13, "Automatic Sprinkler Systems" are summarized as:

1. Except as permitted in Sentences (2), (3) and (4), sprinkler systems are required to comply with the design, construction, installation and testing requirements of NFPA 13.

2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies Up To and Including Four Stories in Height" is permitted to be used in a building of residential occupancy that is not more than four storeys in building height, and Group B-3 occupancies that contain sleeping accommodation for not more than 10 persons with not more than 6 requiring emergency evacuation assistance.

3. NFPA 13D, "Installation of Sprinkler Systems in One and Two Storey Dwellings and Mobile Homes" is permitted to be used in a building of residential occupancy that contains not more than two dwelling units.

4. Where fewer than nine sprinkler heads serve a building, the water supply is permitted to be supplied from the domestic water supply provided that the required flow for the sprinklers can be met by the domestic system.

5. Separate water control valves are required for sprinkler systems and other equipment that are served by the same water supply.

6. Regardless of the requirements of NFPA 13, NFPA 13R and NFPA 13D, sprinklers are required in any room or closet in the storey immediately below a roof assembly that is not fire rated as a result of the waiver in Article 3.2.2.17 for sprinklered buildings that are electrically supervised and alarm signals are transmitted to the fire department.

7. Fast response sprinklers are required in care or detention occupancies and in sprinklered residential occupancies.

8. Sprinklers in elevator machine rooms are required to have a minimum intermediate temperature rating and they are to be protected against physical damage.

Combustible Sprinkler Piping

Sentence 3.2.5.14.(1) limits the use of combustible sprinkler piping to wet systems in residential occupancies and other light hazard occupancies. An example of a light hazard occupancy is Group D, "Business and Personal Services".

Sentences 3.2.5.14.(2), (3) and (4) provide installation restrictions for combustible sprinkler piping.

The protection methods to separate combustible sprinkler piping from the area it serves are waived in Sentence (5) provided that the sprinkler piping has been tested in conformance with ULC/ORD-C199P-M, "Combustible Piping for Sprinkler Systems" and complies with the requirements specified in this document without additional protection.

Sprinklered Service Space

The five Sentences under Article 3.2.5.15. "Sprinklered Service Spaces" are summarized as:

(1) through (3) Provide requirements for sprinklering a service space that is referred to in Sentence 3.2.1.1.(9) and where flooring used for access within the service space is other than catwalks.

(4) The space below a raised floor in a computer room need not be sprinklered provided that the conditions in Clauses 3.2.5.15.(4)(a) through (e) are met.

(5) Sprinklers for: tenant storage rooms in a residential occupancy, combustible refuse storage rooms, and linen and refuse chutes, are permitted to be supplied from the standpipe system provided the conditions in Clauses 3.2.5.15.(5)(a) through (e) are met.

The edition of the NFPA Standard that is mandated by the Code is provided in Part 1, Table 1.3.1.2.

The determination of whether a building or floor area is required to be sprinklered, is provided in the construction requirements of Subsection 3.2.2., "Building Size and Construction Relative to Occupancy".

Sprinklering of Specific Areas

Requirements for sprinklering of specific areas of a building are also provided in:

- Sentence 3.2.1.5.(1) for basements,
- Sentence 3.2.2.15.(2) for more than one storey below ground,
- Sentence 3.2.8.1.(5) for two-storey interconnected floors within an elementary or secondary school,
- Sentence 3.2.8.2.(5) & (6) for interconnected floors for stairs, and interconnected floors between the first storey and one adjacent storey,
- Article 3.2.8.7. for interconnected floor areas and storeys below,
- Article 3.3.5.2. references the Fire Code and the National Fire Code of Canada for Industrial occupancies for additional requirements for automatic fire extinguishing systems,
- Sentence 3.3.5.4.(7) for storage garages and repair garages located below grade,
- Sentence 3.6.2.5.(1) for combustible refuse storage rooms, and
- Sentence 3.6.3.3.(6) for linen and refuse chutes.

Fire Department Connections

Article 3.2.5.16. "Fire Department Connections" provides the following criteria for the installation of fire department siamese connections:

- Maximum permitted unobstructed distance of 45 m to a fire hydrant for a connection for a standpipe system or automatic sprinkler system.

- The fire department siamese connections must be located outside a building, adjacent to a street or fire route, and not more than 900 mm or less than 300 mm above the ground level.

- Be provided with two 65 mm female swivel hose couplings.

Refer also to Article 3.2.5.5. "Location of Access Routes" for maximum distance requirements between the fire department connections, the fire access route, and firefighter travel distance.

Portable Fire Extinguishers

Article 3.2.5.17. "Portable Fire Extinguishers" refers to Part 6 of the Fire Code for the installation of portable fire extinguishers in buildings.

In a Group B, Division 1 major occupancy, portable fire extinguishers are permitted to be located in secure areas, or in lockable cabinets provided:

a) identical keys for all cabinets are located at all supervisory or security stations, or
b) electrical remote release devices are provided and are connected to an emergency power supply [3.2.5.17.(2)].

Protection From Freezing

Article 3.2.5.18. "Protection from Freezing" applies to any equipment that forms part of a fire protection system that may be adversely affected by freezing temperatures and is located in an unheated area.

Fire Pumps

Article 3.2.5.19. "Fire Pumps" requires that fire pumps with a rated discharge pressure exceeding 280 kPa (40.6 psi) are required to be installed in compliance with NFPA 20, "Installation of Stationary Pumps for Fire Protection".

A requirement to provide a fire pump for a sprinkler system may be the result of a requirement to provide adequate flow requirements for the sprinkler heads. A requirement to provide a fire pump for a standpipe system may be the result of flow requirements in Subsection 3.2.9. "Standpipe Systems" of the Code.

EXERCISE #5-2

(Circle the correct answer and cite Code reference)

1. Combustible sprinkler piping for wet systems is permitted by Subsection 3.2.5 in:

   a) Commercial occupancies up to 1 storey in building height

   b) Only residential occupancies

   c) Light hazard occupancies

   d) Any occupancy, other than Group F, Div.1 and 2, up to 3 storeys.

   ______________________________ [______________]

2. Combustible sprinkler piping is not required to be separated from the space it serves:

   a) where plywood not less than 9.5 mm thick is used to protect the piping

   b) if it meets ULC/ORD-199P-M

   c) if it is tested in accordance with ULC/ORD-199P-M and has shown to meet the requirements in that document without additional protection.

   ____

   ______________________________ [______________]

3. Sprinkler protection is not required in a space below a raised floor in a computer room provided specific conditions are met. Which statement below is not an applicable condition?

a) The optical fibre cables and electrical wires and cables located below a raised floor are installed in noncombustible raceways.

b) The building must be of noncombustible construction and combustible components are permitted in compliance with Subsection 3.1.5.

c) The space below a raised floor must be easily accessible by access sections or panels in the raised floor.

____

____

____

________________________ [____________]

4. Consider a building with a standpipe system. The fire department connection for the standpipe system must be located:

a) Outside of a building within 6 m of a street or an access route.

b) Outside of a building within 900 mm of a street or an access route.

c) Outside of a building adjacent to a street or an access route.

____

____

________________________ [____________]

STOP

5.4 STANDPIPE SYSTEMS (Subsection 3.2.9.)

Standpipe Systems

This portion of Module 5 covers standpipe system requirements for: design installation, water supply, hose stations, hose cabinets, and area of coverage.

Where Required

A standpipe system is required by Sentence 3.2.9.1.(1) to be installed in every building that:

- is more than 3 storeys in building height
- is more than 14 m high measured between the grade and the ceiling of the top storey, or
- when less than 14 m high, has a building area exceeding the area shown in Table 3.2.9.1, for the applicable occupancy classification and number of storeys, if the building is not sprinklered.
- Group B occupancies are not included in the table since all Group B occupancies are required to be sprinklered.

Basements and Below Ground

Sentence 3.2.9.1.(2) requires a standpipe system to be installed in every basement of a building that requires a standpipe system above grade.

Sentence 3.2.9.1.(3) requires a standpipe system is to be installed in every basement of a building that is regulated by Sentence 3.2.2.15.(2) (erected below the adjoining finished ground level and extends more than one *storey* below that ground level).

Exceptions - Smaller Spaces and Open Air Garages

A standpipe system is not required by Sentence 3.2.9.1.(4) to be installed in the lowest storey in a building if this storey is a service room, which has a floor area not exceeding 50 m^2.

A standpipe system is not required by Sentence 3.2.9.1.(5) to be installed in a rooftop enclosure if this enclosure has a floor area not exceeding 50 m^2.

Table 3.2.9.1
Building Limits Without Standpipe Systems
Forming Part of Sentence 3.2.9.1.(1)
(for unsprinklered buildings)

Occupancy Classification	Building Area, m^2		
	1 storey	2 storeys	3 storeys
A	2500	2 000	1 500
C	2,000	1 500	1 000
D	4 000	3 000	2 000
F, Division 2	2 000	1 500	1 000
F, Division 3	3 000	2 000	1 000
Column 1	2	3	4

A standpipe system is not required by Sentence 3.2.9.1.(6) in an open-air storage garage, that is not more than 15 m high, and that conforms to Article 3.2.2.83. (all storeys constructed as open-air storeys, having no other occupancies, of noncombustible construction, not more than 10,000 m^2 in building area, and every portion of each floor area is within 60 m of an exterior wall opening).

Exception for Dwelling Units

A standpipe system is not required by Sentence 3.2.9.1.(7) to be installed in a dwelling unit which:

- does not exceed 3 storeys above adjacent ground level,

- is completely cut off from the remainder of the building so that there is no access to the remainder of the building (e.g. townhomes), and
- has direct access to its interior by means of an exterior doorway located not more than 1,500 mm above or below the adjacent finished ground level.

EXERCISE #5-3

Circle the correct answer and cite the applicable Code requirement.

1. Consider a building with a building height of 14 m and not sprinklered. Which one of the following building areas, occupancy classification and number of storeys will require the installation of a standpipe system?

   a) occupancy classification D, 1 storey, 2,000 m^2

   b) occupancy classification F, Division 3, 2 storeys, 1,500 m^2

   c) occupancy classification A, 3 storey, 2,000 m^2

   d) occupancy classification C, 2 storeys, 1,000 m^2

   ____

   ____

   ______________________________ [__________]

2. Consider a building that requires a standpipe system and includes a rooftop enclosure. Which one of the following enclosure floor areas requires a standpipe hose station?

   a) 50 m^2
   b) 55 m^2
   c) 5 m^2
   d) none of the above

   ____

   ____

   ______________________________ [__________]

STOP

Standpipe System Design

Sentence 3.2.9.2.(1) requires the design, construction, installation and testing of a standpipe system to be in conformance with NFPA 14 "Installation of Standpipe and Hose Systems", except as modified and otherwise provided in Subsection 3.2.9. "Standpipe Systems".

NFPA 14 is the base conformance standard and the additional requirements in Subsection 3.2.9. provide further restrictions and relaxations to NFPA 14.

Standpipe Riser

A standpipe riser is required by Sentence 3.2.9.2.(9) to be located in an exit stair shaft or in a service space.

Dry Standpipe Not Connected to Water Supply

A dry standpipe system that is not connected to a water supply is not considered by Sentence 3.2.9.2.(2) as fulfilling the requirements of standpipe system design by the Code.

Dry Standpipe

If freezing of piping may occur, a dry standpipe system is permitted by Sentence 3.2.9.2.(8) provided that listed devices are used to:

- automatically admit water to the system by the opening of a hose valve, and

- transmit a signal to an attended location.

Water Supply and Pressure (see Appendix A)

If more than one standpipe is provided, the total water supply need not be more than 30 L/s (1800 L/min.) [Sentence 3.2.9.2.(3)].

The residual water pressure at the design flow rate at the hydraulically most remote hose connection of a standpipe system that is required to be installed in a building is permitted by Sentence 3.2.9.2.(4) to be less than 450 kPa provided that:

- the building is sprinklered,
- the water supply at the base of the sprinkler riser is capable of meeting the design flow rate and pressure demand of the sprinkler system, including the inside and outside hose allowance, and
- fire protection equipment (fire department pumper) is available to deliver, by means of the fire department connection, the full demand flow rate at a residual water pressure of 450 kPa at the hydraulically most remote hose connection of the standpipe system.

Fire Department Connections and Fire Pumps

A fire department connection is required by Sentence 3.2.9.2.(5) to be provided for every standpipe system.

Pumps having a rated net head pressure greater than 280 kPa and their controllers are required by Sentence 3.2.9.2.(6) to be listed and labeled.

Couplings for hoses or other fittings used in connection with such couplings are required by Sentence 3.2.9.2.(7) to conform to ULC-S513 "Threaded Couplings for 38 mm and 65 mm Fire Hose" or ULC-S543 "Internal Lug Quick Connect Couplings for Fire Hose".

Supervisory Signal Annunciation for Valves

If a fire alarm system in a building has an annunciator, each valve, except for hose valves (38 mm and 65 mm hose connections) controlling water supplies in a standpipe system is required by Sentence 3.2.9.5.(1) to be equipped with an electrically supervised switch for transmitting a signal for individual annunciation in the event of movement of the valve handle.

EXERCISE #5-4

Circle the correct answer and cite applicable Code requirement.

1. In a sprinklered building, the Code permits the residual water pressure in a standpipe system to be less than 450 kPa under a set of conditions. Which one of the following is a specific part of that set of conditions?

   a) The water supply for the sprinkler system is sufficient to meet the flow demands at the base of the riser for the sprinkler system + the inside and outside hose allowance demand.

   b) provided that the demand does not exceed 1890 L/min

   c) any dry standpipes are connected to a water supply

   d) is only applicable for the 65 mm hose connection.

   ____

   ____________________________ [______________]

2. Based on Article 3.2.9.2., dry standpipe systems are:

   a) not permitted by the Code,

   b) permitted by the Code provided it is connected to a water source,

   c) required by the Code to be pressurized with nitrogen,

   d) are only permitted in sprinklered buildings.

   ____

   ____________________________ [______________]

STOP

Hose Connections

If a standpipe system is required by Article 3.2.9.1. "Where Required" in a building, 38 mm diameter hose connections are required by Sentence 3.2.9.3.(1) to be provided in each storey of the building.

In addition, if a standpipe system is required, 65 mm diameter hose connections are required by Sentence 3.2.9.3.(2) to be installed in each storey of the building, if the building:

- is more than 25 m high, measured between grade and the ceiling of the top storey, or
- has a building area of more than 4,000 m^2.

Hose Stations

- If a standpipe system is required in a building by Article 3.2.9.1., hose stations are required by Sentence 3.2.9.4.(1) to be provided in each storey of the building.

Each hose station is to be equipped with a hose rack filled with not more than 30 m of 38 mm diameter fire hose. The hose rack and fire hose are to be listed, or approved by the Factory Mutual Research Corporation.

Hose Cabinets

At each hose station, the hose connections, valves, fire hose, nozzle and hose rack are required by Sentence 3.2.9.4.(3) to be located inside a hose cabinet (except in a Group F occupancy). A hose cabinet is to be of sufficient size to contain the above equipment, contain a listed fire extinguisher, and provide sufficient clearance to permit the use of a standard fire department hose key.

Hose Station Location

Hose stations are required by Sentence 3.2.9.4.(5) to be located:

- so that every portion of the building can be reached by a hose stream within 3 m of a nozzle attached to the hose,
- not more than 5 m from every required exit serving a floor area, except for the first storey, and where additional hose stations are required to achieve full coverage of the floor area,
- in a conspicuous location where they are not likely to be obstructed.

Hose stations are required by Sentence 3.2.9.4.(6) to be located so that it is not necessary to penetrate an exit with a hose in order to provide the design coverage.

A hose is permitted to penetrate an exit, however, in order to provide the required coverage to:

- a service room referred to in Sentence 3.2.9.1.(4) (i.e. the lowest storey in a building that is a service room and does not exceed a floor area of 50 m^2),
- a rooftop enclosure referred to in Sentence 3.2.9.1.(5) (i.e. rooftop enclosure that does not exceed a floor area of 50 m^2),
- a room not more than 50 m^2 in area, or
- a room or group of rooms not more than 200 m^2 in area in a sprinklered floor area.

A hose station located on one side of a horizontal exit is considered to serve only the floor area on that side of the horizontal exit [Sentence 3.2.9.4.(8)].

A hose cabinet is to be located so that its door, when fully opened, will not obstruct the required width of a means of egress [Sentence 3.2.9.4.(9)].

Secure Areas and Lockable Cabinets

A hose station in a Group B, Division 1 major occupancy (Detention) is permitted by Sentence 3.2.9.4.(10) to be located in a secure area, or in a lockable cabinet provided that

- identical keys for all cabinets are located at all guard stations, or
- electrical remote release devices are provided and are connected to an emergency power supply.

EXERCISE #5-5

Circle the correct answer and cite the applicable Code requirement.

1. Consider a building that is 25 m (82 ft) high and requires a standpipe system. Which one of the following conditions meet the requirements of the Code?

   a) a building area of 4,000 m^2, 65 mm connections required,

   b) a building area of 4,310 m^2, 65 mm connections required,

   c) a building area of 4,000 m^2, no 38 mm connections,

   d) a building area of 4,310 m^2, no 65 mm connections.

   ____

   ______________________________[______________]

2. Complete the statement with the correct phrase.

   Based on Subsection 3.2.9., hose station cabinets:

   a) are required for all occupancies

   b) are not required where tampering may occur

   c) are not required in only high hazard industrial occupancies (Group F, Division 1)

   d) are not required in any industrial occupancy.

   ____

   ______________________________[______________]

STOP

Water Supply for 38 mm Hose Connections

If a standpipe and hose system is required, Article 3.2.9.6. requires the water supply to be sufficient to provide a flow, measured at each of the two hydraulically most remote 38 mm diameter hose connections:

- of not less than 380 L/min
- for not less than 30 min
- at a pressure of not less than 450 kPa, and
- of not less than 190 L/min from each of the two outlets simultaneously.

Water Supply of 65 mm Hose Connections

If 65 mm diameter hose connections are required by Sentence 3.2.9.3.(2), the water supply is required by Sentence 3.2.9.7.(1) to be sufficient to provide a water flow, measured at each of the two hydraulically most remote 65 mm diameter hose connections:

- of not less than 1,890 L/min
- for not less than 30 min
- at a pressure of not less than 450 kPa (65.3 psi), and
- of not less than 945 L/min from each of the two outlets simultaneously.

The following table summarizes standpipe system flow design as required by Articles 3.2.9.6. and 3.2.9.7.

Building Height (m) or Building Area (m^2) (1)	38 mm Hose Connections	65 mm Hose Connections	Minimum Flow (L/min)	Minimum Duration (min)	Minimum Pressure (kPa)	Flow per Outlet (L/min)
$\leq$ 25 m and $\leq$ 4,000 m^2	required	not required	380	30	450	190
> 25 m	required	required	1890*	30*	450*	945*
> 4,000 m^2	required	required	1890*	30*	450*	945*

* Notes for 65 mm hose connections:

1. If the building is less than 84 m high, the required water supply may be supplied through the fire department connection for the 65 mm connection [3.2.9.7.(2)].
2. If the building is 84 m or more high, the required water supply is to be provided by sufficient pumping capacity and be provided with not less than two sources of water supply for the 65 mm connection [3.2.9.7.(3)].

EXERCISE #5-6

For each of the following questions, review the presented text and use the applicable references to select the correct answer using the multiple choice method.

1. If a building requiring a standpipe system is 84 m high, what provision is required to conform to the water supply requirements in Subsection 3.2.9.?

   a) water flow is permitted to be supplied through the fire department connection,

   b) the water supply must be available for 45 minutes,

   c) the building must be served by not less than two sources of water supply from a public water system,

   d) supply must be supplemented by a private system.

   ____

   ____________________ [__________]

2. A building requires both 38 mm and 65 mm hose connections. Which one of the following water supply flow capacity is the standpipe riser required to be designed to?

   a) 1,890 L/min
   b) 945 L/min
   c) 450 L/min
   d) 380 L/min

   ____

   ____

   ____________________ [__________]

STOP

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Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 6

COMPLEX BUILDINGS - 2006

ADDITIONAL REQUIREMENTS FOR RENOVATIONS

6.1 INTRODUCTION (Section 11.5)

Section 11.5 specifically addresses Compliance Alternatives.

A Compliance Alternative is a substitute measure permitted in a renovation project where the Chief Building Official is satisfied that the required compliance with new construction requirements of the Code (Division B, Parts 3, 4, 6 or 8) is impractical due to structural or construction difficulties or is detrimental to the preservation of a heritage building [11.5.1.1.(1)].

The application of a Compliance Alternative to a Part 9 or Part 12 building requirement needs only to meet the condition that the required new construction requirement is impractical [11.5.1.1.(2)].

The performance level of the building after construction must not be less than the performance level of the building prior to construction [Article 11.3.1.1.] where an existing building system is materially altered or repaired.

Compliance Alternative is a defined term and will be defined in the next section.

The requirements of Section 11.5 are alternatives to the requirements of "other Parts of the Code" as they apply to the proposed construction.

In the Large Buildings - 2006 course, the additional requirements for change of use in Section 3.17 are reviewed.

Objectives

- Demonstrate the ability to find, understand and apply the Code requirements related to Section 11.5.
- Demonstrate comprehension of applying the 11.5.1 series

of Tables in Section 11.5.

- Reference applicable standards.

STOP

6.2 OVERVIEW

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 and Division B, Part 11 of the Code and from the Building Code Act Definitions. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the OBC and are identified in italics text. While shown in italics in this section, defined terms will not be italicized throughout the remainder of this module.

Building system
Building system means a combination of elements or components that form a complete major division of *construction* in the design of a *building* or part of a *building*, including a structural or framing system, a waterproofing system, a *drainage system*, an exterior cladding system, a roofing system, a window system, a partition system, a corridor system, a stair system, a fire alarm and detection system, a sprinkler system or a heating, ventilation or *air conditioning system*, a *foundation* system, a standpipe and hose system, a flooring system, a *plumbing system*, a *sewage system* or an electrical system.

Compliance alternative
Compliance alterative means a substitute for a requirement in another Part of Division B of the Code that is listed in Part 10 or 11 of Division B, and "C.A." has a corresponding meaning.

Construct
Construct means to do anything in the erection, installation, extension or material alteration or repair of a building and includes the installation of a building unit fabricated or moved from elsewhere and "construction" has a corresponding meaning.

Construction index

Construction index means a level on a scale of 1 to 8 determined in accordance with Table 11.2.1.1.A. of Division B designating the expected performance level of the building structure with respect to the type of construction and fire protection of an existing building, and "C.I." has the corresponding meaning.

Heritage building

Heritage building means a building designated under the Ontario Heritage Act, or a building that is certified to be of significant architectural or historical value by a recognized, non-profit public organization whose primary object is the preservation of structures of architectural or historical significance and the certification has been accepted by the Chief Building Official.

Major occupancy

Major occupancy means the principal occupancy for which a building or part of a building is used or intended to be used, and is deemed to include the subsidiary occupancies that are an integral part of the principal occupancy.

Performance level

Performance level means that level of performance under which all or part of an existing building functions with respect to its building systems.

STOP

6.3 SCOPE & BACKGROUND

A renovation project is a complex exercise in the application of the Building Code. The use of Compliance Alternatives is a result of first considering and assessing the application of new construction requirements as they apply to a renovation project.

It is not within the scope of this module to address the processes in Sections 11.2. "Classification of Existing Buildings", 11.3., "Proposed Construction", and 11.4., "Performance Level Evaluation and Compensating Construction". However, a brief overview is in order to appreciate the impetus for using Section 11.5.

> "Except as provided in Article 11.3.3.1. and Section 11.5., the design and *construction* of a new *building system* or the extension of an existing *building system*, shall comply with all other Parts of the Code" [Article 11.3.1.2.].

Article 11.3.1.2. introduces the use of Subsection 11.5 as an exemption, along with Article 11.3.3.1., "Basic Renovation", in compliance with "other Parts of the Code" (i.e. new construction requirements) for the construction of a new building system or the extension of an existing building system.

Article 11.3.3.1., "Basic Renovation" applies to construction that maintains the existing performance level of any part of a building (e.g. relocating, reusing or extension of existing building systems using the same or similar materials or components) to retain the existing:

- character,
- structural uniqueness,
- heritage value, or
- aesthetic appearance, and

provided that the construction will not adversely affect the early warning and evacuation systems, fire separations, the structural adequacy, or create an unhealthy environment in the building [11.3.3.1.(1)].

Article 11.3.3.1. also applies to construction that is required by Part 9 of Division B of the Fire Code (retrofit requirements) for a hotel [11.3.3.1.(2)].

Whereas the principles expressed in Article 11.3.1.2. apply to building systems, the same principles are applied by Article 11.3.2.1. to buildings. The extended portions of a building are required to comply with "other Parts of the Code" (new construction requirements) and the existing part of the building is subject to Part 11.

STOP

EXERCISE #6-1

Take 5 minutes to read Subsection 11.3.1. and answer the following question.

Circle the best answer and cite the applicable Code reference.

1. Consider a renovation project of an interior fit-up of the 8th floor of an office building. The floor area is a single tenant floor area. The scope of the project is to construct new demising partitions for offices in approximately 50% of the floor area. As a result, air supply diffusers need to be relocated. As a consequence, new sections of ducts are proposed for the new diffuser locations.

   Only short new duct runs will be installed. Which requirement is considered as most appropriate to apply to the new sections of ducts?

   a) The new duct sections are required to comply with "other parts of the Code".

   b) The new duct sections are permitted to "maintain the existing performance level".

   c) The renovation is considered as extensive renovation, and as such, new duct sections are required to comply with "other Parts of the Code" (new construction requirements).

6.4 APPLICATION (Subsection 11.5.)

Where it is determined that the renovation or construction of an existing building system is required by Subsection 11.3.1., or elsewhere, to comply with "other Parts of the Code", Section 11.5., "Compliance Alternatives" is permitted to be applied in lieu of requirements in "other Parts of the Code" under the following conditions:

- Sentence 11.5.1.1.(1) applies to all buildings. Compliance Alternatives are permitted to substitute requirements in Parts 3, 4, 6, or 8 where the Chief Building Official is satisfied that compliance with the above Parts of the Code are impracticable because of structural or construction difficulties, or are detrimental to the preservation of a heritage building [11.5.1.1.(1)].

  Sentence 11.5.1.1.(2) applies to Part 9 or 12 requirements. Compliance Alternatives are permitted to substitute a requirement in Part 9 or 12 without satisfying the Chief Building Official that compliance with the requirement is impracticable.

6.5 COMPLIANCE ALTERNATIVES (Article 11.5.1.)

Compliance Alternatives shown in Tables 11.5.1.1.A, 11.5.1.1.B, 11.5.1.1.C, 11.5.1.1.D/E, and 11.5.1.1.F may be substituted for a requirement contained in Parts 3, 4, 6 or 8, where the Chief Building Official is satisfied that compliance with the requirement is impracticable because of structural or construction difficulties, or that it is detrimental to the preservation of a heritage building.

Compliance Alternatives shown in Tables 11.5.1.1.A, 11.5.1.1.B, 11.5.1.1.C, 11.5.1.1.D/E, and 11.5.1.1.F may be substituted for a requirement contained in Parts 9 or 12 without satisfying the Chief Building Official that compliance with the requirement is impracticable. Each Table applies to a specific occupancy or occupancies as follows:

- Table 11.5.1.1.A – Assembly Occupancies
- Table 11.5.1.1.B – Care or Detention Occupancies
- Table 11.5.1.1.C – Residential Occupancies
- Table 11.5.1.1.D/E – Business/Mercantile Occupancies
- Table 11.5.1.1.F – Industrial Occupancies

Each Table has three columns:

- The first column is the "Compliance Alternative" number reference,
- The second column is the "Code Requirements" that is permitted to be substituted, and
- The third column is the Part 11 "Compliance Alternative" that is permitted for the "Code Requirements" in the second column.

For example:

Table 11.5.1.1.A		
NUMBER	PART 3 REQUIREMENTS	PART 3 COMPLIANCE ALTERNATIVE
A19	3.2.5.3.(1) and (2)	Existing Acceptable

It should be noted that not all Code requirements are listed in the Tables, since Compliance Alternatives do not exist for every Code Requirement.

EXERCISE #6-2

Answer the following based on Tables 11.5.1.A through F.

1. What is a Part 11 Compliance Alterative for Article 3.2.4.21., which states that all smoke alarms are to be hard wired in a residential occupancy?

____

____

____

____

______________________________ [ ]

STOP

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PARTICIPANT MODULE 7

COMPLEX BUILDINGS - 2006

PART 5
ENVIRONMENTAL SEPARATION

SUPPLEMENTARY STANDARD SB-8 ANCHORAGE FOR FIXED ACCESS LADDERS

SECTION 3.9 - PORTABLE CLASSROOMS

SECTION 3.10 - SELF-SERVICE STORAGE BUILDINGS

SECTION 3.11 - PUBLIC POOLS

3.12 - PUBLIC SPAS

SECTION 3.13 - RAPID TRANSIT STATIONS

SECTION 3.14 - TENTS AND AIR-SUPPORTED STRUCTURES

SECTION 3.15 - SIGNS

SECTION 3.16 - SHELF AND RACK STORAGE SYSTEMS

7.1 PORTABLE CLASSROOMS

Except as provided in Section 3.9. of the Code, the requirements of the Code apply to portable classrooms. Portable classrooms are reviewed in the Large Buildings - 2006 course.

7.2 SELF-SERVICE STORAGE BUILDINGS

Except as provided in Section 3.10. of the Code, the requirements of the Code apply to self-service storage buildings. Self-service storage buildings are reviewed in the Large Buildings - 2006 course.

7.3 PUBLIC POOLS

Section 3.11. of the Code applies to the design and construction of site assembled and manufactured pools that are intended for use as public pools. Public pools are reviewed in the Large Buildings - 2006 course.

7.4 PUBLIC SPAS

Section 3.12. of the Code applies to the design and construction of site assembled public spas and factory built public spas. Public spas are reviewed in the Large Buildings - 2006 course.

7.5 RAPID TRANSIT STATIONS

Except as provided in Section 3.13. of the Code, the requirements of the Code apply to rapid transit stations. Rapid transit stations are reviewed in the Large Buildings - 2006 course.

7.6 TENTS AND AIR-SUPPORTED STRUCTURES

Except as provided in Section 3.14. of the Code, tents are exempted from complying with the requirements of the Code. However, air-supported structures must comply with the Code, other than where exempted in Subsection 3.14.2. Tents and air-supported structures are reviewed in the Large Buildings - 2006 course.

7.7 SIGNS

Except as provided in Article 3.15.1.2., Section 3.15. applies to the erection of all signs. Signs are reviewed in the Large Buildings - 2006 course.

7.8 SHELF AND RACK STORAGE SYSTEMS

Section 3.16. of the Code applies to shelf and rack storage systems. Shelf and rack storage systems are reviewed in the Large Buildings - 2006 course.

7.9 INTRODUCTION

Building Code - Part 5

Part 5 applies to all buildings except those within the scope of Part 9 [5.1.1.1.(1), Subsection 1.1.2., Division A].

Objectives

1. Identify requirements governing heat transfer, air leakage, vapour diffusion, protection from precipitation, surface water and moisture in the ground.

2. Locate Code references to 'referenced standards' pertaining to wind, water and vapour protection.

7.10 OVERVIEW

The following terms from the Building Code, Division A, Part 1, Article 1.4.1.2., used in this module, are defined. The definitions provided below are for information purposes only. Reference should be made to the respective definition in the official volume. While the definitions below appear in italics, they will not be italicized throughout the remainder of this module.

Air barrier system
Air barrier system means the assembly installed to provide a continuous barrier to the movement of air.

Conditioned space
Conditioned space means any space within a building the temperature of which is controlled to limit variation in response to the exterior ambient temperature or interior differential temperatures by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year.

Foundation

Foundation means a system or arrangement of foundation units through which the loads from a building are transferred to supporting soil or rock.

Soil

Soil means that portion of the earth's crust which is fragmentary, or such that some individual particles of a dried sample may be readily separated by agitation in water; it includes boulders, cobbles, gravel, sand, clay and organic matter.

Vapour barrier

Vapour barrier means the elements installed to control the diffusion of water vapour.

7.11 APPLICATION

Part 5 regulates the separation of environmentally dissimilar spaces. Most obvious is the need to separate indoor conditioned spaces from unconditioned spaces, the outdoors or the ground. There are also cases where separation is needed between interior spaces which are intended to provide different environments. This part also applies to site conditions that may affect moisture loading on building elements that separate interior space from exterior space and the ground.

The requirements address the design:

- and construction, or selection of building components such as windows and doors,
- and construction of building assemblies, such as walls, floors and roofs,
- and construction of the interfaces of the components in assemblies noted above,
- or selection and installation of site elements such as backfill, grading and drainage.

An extreme example of the separation of significantly different interior environments would be a wall that separates an indoor ice rink from an indoor swimming pool.

Part 5 provides explicit requirements for controlling the transfer of heat, air and moisture in various forms, including water leakage and ground water. Requirements for radon and other soil gases are included with those related to air leakage.

Part 5 is divided into ten sections.

Section 5.1.	General Requirements
Section 5.2.	Loads and Procedures

- refers to Supplementary Standard SB-1 for exterior environmental loads
- refers to Sentence 6.2.1.1.(1) for interior environmental loads
- refers to ASHRAE handbook for heat, air and moisture calculations and Part 4 for wind load calculations

Section 5.3.	Heat Transfer
Section 5.4.	Air Leakage
Section 5.5.	Vapour Diffusion
Section 5.6.	Precipitation
Section 5.7.	Surface Water
Section 5.8.	Moisture in the Ground
Section 5.9.	Sound Transmission
Section 5.10.	Standards

The Large Buildings - 2006 course examines in greater detail the requirements in Part 5.

EXERCISE #7-1

1. In Section 5.2., how are interior environmental loads derived?

   ____

   ______________________________ [______________]

2. Refer to Article 5.3.1.2. and list the types of metal frame windows and doors that are exempt from the requirement for a thermal break. Give Code references.

   ____

   ______________________________ [______________]

3. When is a vapour barrier required in a building component or assembly?

   ____

   ____

   ______________________________ [______________]

STOP

7.12 DESIGN CONSTRUCTION AND INSTALLATION OF ANCHORAGE SYSTEMS AND FIXED LADDERS (SB-8)

Fixed ladders that are installed to provide access to the roof of a building are required by Sentence 3.6.1.5.(1) to have their attachment and anchorage systems designed and installed in accordance with the Supplementary Standard SB-8.

The design live load should be divided into two concentrated loads of 1.1 KN for each attachment.

Ice, wind, rigging, impact and dead loads must be considered in the design, and a safety factor of 4:1 should be applied for normal usage.

Expansion anchors should be avoided in masonry walls. Through-bolted connections or an equivalent must be used in masonry walls. Attachment anchor bolts should be a minimum of 12 mm in diameter.

The maximum spacing of attachments for a steel ladder is 3 metres.

To provide an improved margin of safety, there should be two means of anchorage at the top of the ladders. If a ladder has to be attached to an existing wall, the structural soundness of the walls should be investigated.

Take 10 minutes to read Supplementary Standard SB-8 and answer the following questions. Provide references with answers where applicable. Discuss answers with your group to obtain a consensus.

EXERCISE #7-2

1. What is the minimum design live load between two consecutive attachments in a fixed ladder?

____

______________________ [__________]

2. What type of anchor should be avoided when fastening a ladder onto a masonry wall?

____

______________________ [__________]

3. What should be done to provide an improved margin of safety for fixed access ladders?

____

______________________ [__________]

STOP

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PARTICIPANT MODULE 8

COMPLEX BUILDINGS - 2006

ADDITIONAL REQUIREMENTS FOR HIGH BUILDINGS

8.1 INTRODUCTION

This module will concentrate on understanding the additional requirements for high buildings. Building Code requirements applicable to high buildings are provided in Subsection 3.2.6.

High buildings may be typified by the general characteristics of requiring more time to evacuate in an emergency and increased difficulties in firefighting. This characteristic results principally from the height and occupant load of the building, but may also include major occupancy factors. This includes Group B detention, care and treatment major occupancies in buildings of moderate height, where evacuation of occupants may be difficult due to security or health concerns. In some circumstances, complete evacuation may be impractical and occupants will be relocated to safe portions of a building. Some high building requirements are therefore related to enhanced fire protection within buildings to facilitate a protect-in-place approach.

The height of high buildings may also delay firefighters' response to a fire. Some requirements are therefore related to enhanced fire suppression, firefighters' access and safety.

Tall buildings are also more susceptible to stack effects, than are lower buildings. Stack effects are caused by differences in interior and exterior air temperature and pressures. The effect is most pronounced in winter, when the temperature differential is greatest. During this season, the stack effect causes air to rise from lower to upper storeys in high buildings. In the event of fire, the stack effect can assist to spread the effects of fire vertically throughout the building.

Objectives

Upon completion of this module, you will be able to:

- Identify buildings that are classified as high buildings.
- Identify factors that necessitate additional requirements for high buildings.
- Identify means for smoke control.
- Identify approaches for smoke venting to aid firefighters.
- Identify additional requirements for fire alarm systems.

8.2 APPLICATION

Article 3.2.6.1. identifies building attributes that result in high building classification and the application of requirements in Subsection 3.2.6. A building is considered a high building if it meets any one of the criteria described in the following table.

TABLE 8-1

Major Occupancy	Characteristic		Code Reference
	Height[1]	Other	
A, D, E, F	> 36 m		3.2.6.1.(1)(a)(i)
	> 18 m	$\frac{\text{total occupant load above first storey}}{1.8 \times \text{total exit width (m)}}$ =>300	3.2.6.1.(1)(a)(ii)
B	> 18 m		3.2.6.1.(1)(b)
	no minimum	B-2 or B-3 occupancy located above 3rd storey	3.2.6.1.(1)(c))
C	> 18 m		3.2.6.1.(1)(d)

[1] Height is measured from 'grade' to the floor level of the top storey.

Example:

Determine whether the following building is classified a high building (Refer to Figure 8-1):

A 7 storey building is constructed with storeys having 4 m floor-to-floor heights. The first 3 storeys contain retail major occupancies and the top 4 floors contain offices. The first storey has an occupant load of 675 persons. Each other retail floor has a 450 person occupant load. Each office floor has a 200 person occupant load. The building is served by three 1,400 mm wide exit stairs.

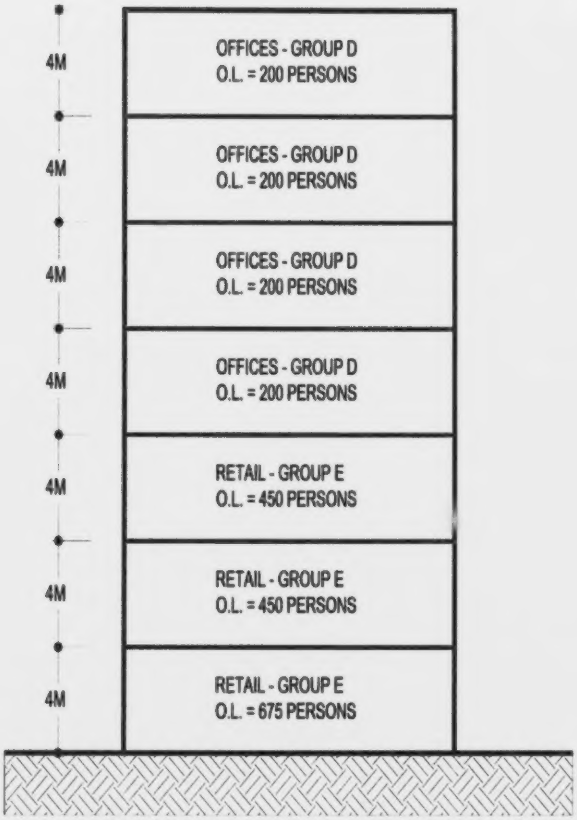

4M
OFFICES - GROUP D
O.L. = 200 PERSONS
4M
OFFICES - GROUP D
O.L. = 200 PERSONS
4M
OFFICES - GROUP D
O.L. = 200 PERSONS
4M
OFFICES - GROUP D
O.L. = 200 PERSONS
4M
RETAIL - GROUP E
O.L. = 450 PERSONS
4M
RETAIL - GROUP E
O.L. = 450 PERSONS
4M
RETAIL - GROUP E
O.L. = 675 PERSONS

FIGURE 8-1

Solution:

Major occupancy: D and E, therefore Clause 3.2.6.1.(1)(a) applies.

Building height: 6 storeys x 4 m/storey = 24 m to the floor level of the top storey, therefore Subclause 3.2.6.1.(1)(a)(ii) applies.

Cumulative occupant load: (2 x 450) + (4 x 200) = 1,700 persons above the first storey.

Total exit width: 3 exits x 1.4 m = 4.2 m

Occupant load/exit width factor: 1,700/(1.8 x 4.2) = 225

The occupant load/exit width factor is less than 300, therefore the building is not a high building.

STOP

8.3 LIMITS TO SMOKE MOVEMENT

Smoke movement is required to be limited in high buildings to reduce the danger to occupants and firefighters from exposure to smoke from a building fire [3.2.6.2.(1)].

The intent of the Code is to limit the quantity of contaminated air in storeys, other than the storey of fire origin, to not more than 1% by volume for a period of 2 hours, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis [3.2.6.2.(2)].

This represents a performance objective. Prescriptive requirements for achieving this level of performance are not detailed in the Code. Supplementary Standard SB-4 describes a series of measures which are deemed to achieve the required performance. These measures do not prohibit the use of other designs, however, the Chief Building Official must be satisfied that the design will provide the level of performance required by the Code.

Other means to limit smoke movement are also applicable to exit stair shafts both above and below exit levels, and to firefighters' elevator shafts, in consideration that these are means of occupant evacuation and emergency response during a fire [3.2.6.2.(3), (4), (5) and (6)].

EXERCISE #8-1

Take 30 minutes to complete the following questions.

1. Identify which of the following buildings are regulated by Subsection 3.2.6. (assume first storey is at grade).

   a) 15 storey office building having 3.5 m high storeys

   ____

   ____________________ [__________]

b) 4 storey hospital with patient care on all storeys. Storey heights are 4 m

____

________________________[______________]

c) 6 storey residential building having 3.4 m storey height

____

________________________[______________]

2. Why is January selected as the month on which to base designs to limit smoke movement?

____

____

____

____

3. If a building is not sprinklered, how must it be designed to limit the danger to occupants and fire fighters from exposure to smoke in a building fire?

____

____

____

________________________[______________]

STOP

8.4 CONNECTED BUILDINGS

Sentence 3.2.6.3.(1) requires interior connections between buildings, such as through a firewall or walkway, to be designed to limit smoke movement between the buildings if one, or both, of the buildings is classified as a high building.

A common means of compliance is described in Supplementary Standard SB-4, Measure N. This is further described in Module 9.

8.5 ELEVATORS

Emergency operation of elevators in high buildings is regulated by Articles 3.2.6.4. and 3.2.4.14. Elevators for firefighters' use are addressed in Article 3.2.6.5.

Emergency recall operation is required for all elevators serving storeys above the first storey [3.2.6.4.(1)].

All elevators require manual recall, initiated by key-operated switches located conspicuously in each elevator lobby at the recall level, and in the central alarm and control facility [3.2.6.4.(2)].

Each elevator car is required to be equipped with in-car emergency service switches [3.2.6.4.(3)].

Automatic recall operation is required for elevators in unsprinklered buildings [3.2.6.4.(5)].

Automatic recall is initiated by the building fire alarm system or smoke detection in each elevator lobby in each storey. [3.2.6.4.(6)]

At least one elevator is required to provide firefighters' service. A firefighters' elevator is required to [3.2.6.5.(1)]:

- be accessible at the storey having the firefighters' principal entrance from the exterior and provide access to all storeys above grade normally served by the elevator system [3.2.6.5.(4)]
- have a useable platform area of 2.2 m^2 and be capable of transporting a 900 kg load to the top floor within 1 minute [3.2.6.5.(2)]
- have electrical conductors for elevator operation located in service spaces containing no other combustible material, or protected against fire exposure for 1 hr [3.2.6.5.(3)(a)].

High buildings may be built with separate elevators to serve selected lower and upper portions of a building to improve the efficiency of passenger service. In such cases, no single elevator may access all storeys served by the elevator system. It is therefore permitted to transfer once between elevators to provide fire fighters with access to all floors. In this circumstance, both elevators are designed as firefighters' elevators. [3.2.6.5.(5)]

Firefighters' elevator doorways must protect firefighters from fire exposure. This is achieved with any one of the following methods [3.2.6.5.(3)]:

- dividing floor areas with fire separations into 2 separate smoke control regions and providing separate firefighters elevator shafts for each region (Measure K),
- doorway closure interlock mechanisms, including interlock circuits and associated wiring, are designed to operate for at least 1 hour under test fire conditions appropriate for doors,
- doors open into unoccupied vestibules separated from the remainder of the floor area with 45 minute rated fire separations,
- doors open into corridors containing no occupancy and separated from the remainder of the floor area with 1 hour rated fire separations.

8.6 VENTING TO AID FIREFIGHTING

Smoke venting of floor areas, both above and below grade, is required in accordance with Article 3.2.6.6.

The following smoke venting methods are permitted in high buildings:

- windows
- wall panels
- smoke shafts
- the building exhaust system

In a building that is not sprinklered it is not permitted to vent smoke with the building mechanical exhaust system. [3.2.6.6.(5)]

In no circumstances is it permitted to use an elevator shaft for smoke venting. [3.2.6.6.(4)]

Detailed design guidelines for smoke venting system are contained in Section 3 of the Supplementary Standard SB-4, which is discussed in Module 9 of this course.

EXERCISE #8-2

Take 15 minutes to read Articles 3.2.6.4. to 3.2.6.6. and complete the following questions.

1. Describe 2 conditions of use of windows for smoke venting.

____

______________________________ [______________]

____

______________________________ [______________]

2. Identify 2 locations where manual elevator recall switches are found.

   a) ______________________________

   ______________________ [__________]

   b) ______________________________

   ______________________ [__________]

3. Does an elevator serving only the first storey and 3 basement parking levels of a high building require emergency recall.

   ____

   ____

   ____

   ____

   ______________________ [__________]

STOP

8.7 CENTRAL ALARM AND CONTROL FACILITY

A central alarm and control facility is the principal incident command location for firefighters in a fire emergency. It is therefore required that the central alarm and control facility be located on the storey containing the principal entrance for firefighters and in a readily accessible location. Sentence 3.2.7.10.(4) requires wiring between fire alarm central processing and other transponders or annunciators in different fire compartments to be protected from fire exposure for a period of at least 1 h.

A summary of primary functions is provided in Table 8-3. Detailed requirements are described in Article 3.2.6.7.

TABLE 8-3

Functions of Central Alarm and Control Facility

System	Function		
	Operate	Monitor	Communicate
Fire alarm	X	X	X(1)
Voice communication	X		X
Sprinkler water flow		X	
Sprinkler supervision		X	
Elevator recall	X (2)	X	
Elevator car communication			X (3)
Door hold-open hardware	X		
Electromagnetic locks	X (4)		
Auxiliary equipment	X (5)		

Notes:

(1) send signals to Fire Department
(2) 3.2.6.4(2)(b)
(3) where required by the Elevating Devices Act
(4) release and reset: 3.4.6.15.(4)(d) and (i)
(5) Communication with a continually staffed auxiliary equipment control centre may be provided in lieu of CACF control [3.2.6.7.(2)(i)]

8.8 VOICE COMMUNICATION

General requirements for voice communication systems are provided in Sentence 3.2.6.8.(1). Detailed system requirements are described in Article 3.2.4.22.

A voice communication system allows firefighters in the central alarm and control facility to:

- speak to occupants throughout the building, and
- converse with emergency personnel in:
  - each floor area
  - mechanical control centre (if provided).

A voice communication system assists incident commanders to obtain current information on an emergency event, coordinate emergency response activity and provide reassurance and instructions to building occupants.

A voice communication system is required in buildings with:

- the floor level of the top storey more than 36 m above grade, or
- a Group B, Division 2 or 3 occupancy above the third storey.

8.9 EMERGENCY POWER FOR BUILDING SERVICES/PROTECTION OF ELECTRICAL CONDUCTORS

The following high building emergency systems are expected to operate under full load for at least 2 hours after the start of a fire to enable safe evacuation or redistribution of building occupants and to conduct firefighting operations [Sentence 3.2.7.9.(1)]:

- firefighters' elevators
- other elevators serving storeys above the first storey in buildings exceeding 36 m in height
- mechanical and electrical equipment installed to limit smoke movement between storeys and into exit stair and firefighters' elevator shafts
- firefighting water supply if dependent on electrical power
- smoke venting fans.

To assist with the continued operation of emergency systems during a fire, critical electrical conductors serving emergency systems are required to be protected from exposure to fire in accordance with Article 3.2.7.10.

Electrical conductors for fire alarm systems and emergency equipment, described above, shall provide a circuit intergrity rating of at least 1 h when tested in accordance with ULC-S139, including the hose stream test [Sentence 3.2.7.10.(2)]. Electrical power conductors require 1 hour fire protection from the building main emergency power supply to the equipment served, or to the power distribution equipment supplying power to the equipment served when both are located in the same room [Sentence 3.2.7.10.(3)]. Refer to Figure 8-3.

Sentence 3.2.7.10.(4) requires wiring between fire alarm central processing and other transponders or annunciators in different fire compartments to be protected from fire exposure for a period of at least 1 hr.

Fire alarm system branch circuits connecting fire alarm devices to transponders within a storey are not required to be protected [Sentence 3.2.7.10.(7)]. Supply conductors for emergency lighting are required to be protected against fire exposure for a 1 hr period between the emergency power supply and the system panel boards [Sentence 3.2.7.10.(4)].

Wiring from a panel board to lighting units in the same storey are not required to be protected [Sentence 3.2.7.10.(8)].

Electrical conductors may be protected by using conductors having a circuit integrity rating of at least 1 hr [Sentence 3.2.7.10.(2)], or enclosing the conductors in a service space separated from the remainder of the building with a fire separation providing a 1 hr fire-resistance rating [Sentence 3.2.7.10.(6)].

Protection of electrical conductors for the operation of a firefighters' elevator is regulated by Sentence 3.2.6.5.(6). These conductors must have an inherent 1 hour fire-resistance rating, or be enclosed in a 1 hour service space containing no other combustible material.

Protection of Power Conductors

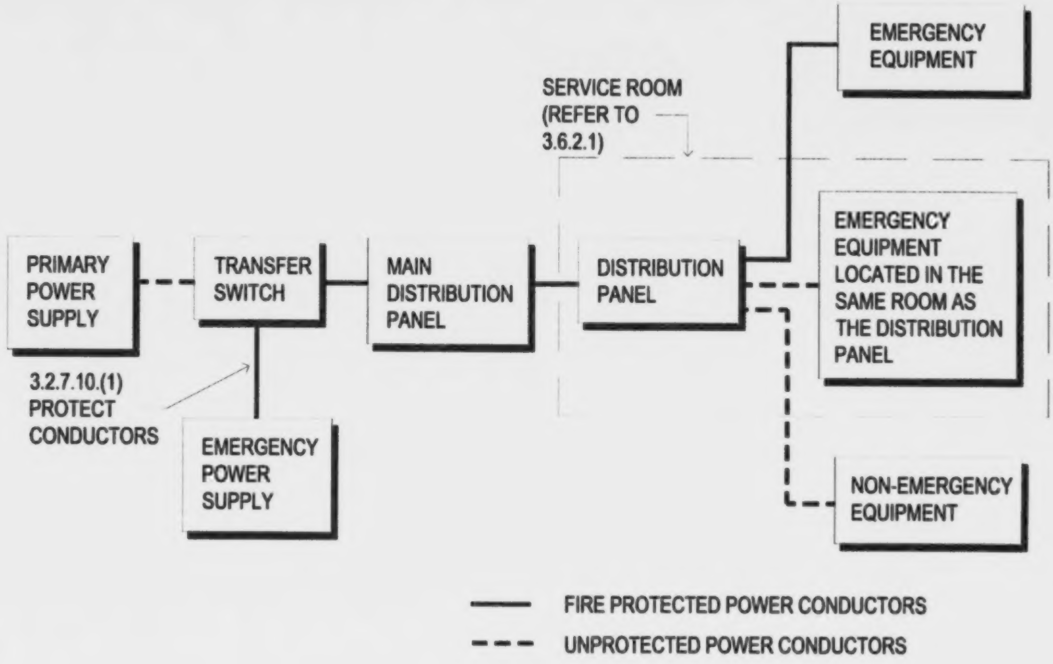

EMERGENCY EQUIPMENT
SERVICE ROOM (REFER TO 3.6.2.1)
PRIMARY POWER SUPPLY
TRANSFER SWITCH
MAIN DISTRIBUTION PANEL
DISTRIBUTION PANEL
EMERGENCY EQUIPMENT LOCATED IN THE SAME ROOM AS THE DISTRIBUTION PANEL
3.2.7.10.(1) PROTECT CONDUCTORS
EMERGENCY POWER SUPPLY
NON-EMERGENCY EQUIPMENT
FIRE PROTECTED POWER CONDUCTORS
UNPROTECTED POWER CONDUCTORS

FIGURE 8-3

Protection of Fire Alarm Wiring and Equipment

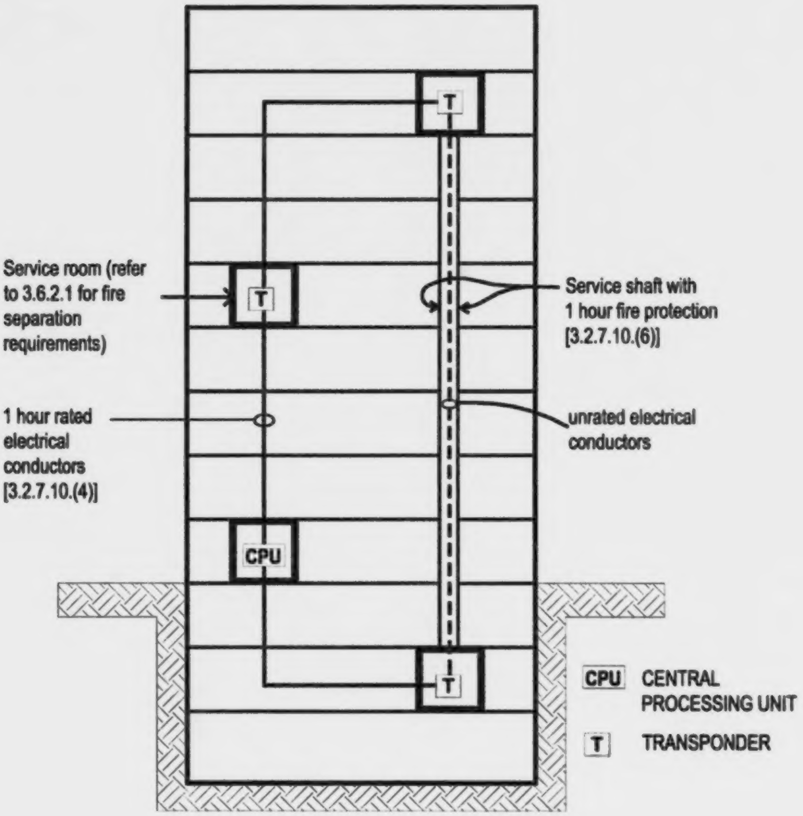

T
Service room (refer to 3.6.2.1 for fire separation requirements)
T
Service shaft with 1 hour fire protection [3.2.7.10.(6)]
1 hour rated electrical conductors [3.2.7.10.(4)]
unrated electrical conductors
CPU
T
CPU CENTRAL PROCESSING UNIT
T TRANSPONDER

FIGURE 8-4

EXERCISE #8-3

Take 10 minutes to complete the following questions.

1. According to Article 3.2.4.22., operation of the voice communication system will temporarily silence fire alarm audible signals to permit voice message transmission, but only after the signals have operated for at least:

   a) 10 seconds in

   ____

   ____________________ [__________]

   b) 30 seconds in

   ____

   ____________________ [__________]

2. A voice communication system must be capable of transmitting voice messages selectively to:

   ____

   ____________________ [__________]

3. Identify the type of monitoring (audible and/or visual) required at the Central Alarm and Control Facility for the following functions:

Function	Monitoring Required		
	Audible	Visual	Code Reference
Fire alarm alert and alarm signals Elevator emergency recall Sprinkler system water flow Sprinkler supervisory signal Sprinkler supervisory audible signal silence switch			

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 9

COMPLEX BUILDINGS - 2006

SUPPLEMENTARY STANDARD SB-4

MEASURES FOR FIRE SAFETY IN HIGH BUILDINGS

9.1 INTRODUCTION

This module extends the scope of Module 8 concerning Building Code requirements for high buildings. This module explains the use of Supplementary Standard SB-4, "Measures for Fire Safety in High Buildings" of the Building Code.

You will recall from Module 8 that the Code generally requires limiting the quantity of contaminated air in storeys of high buildings (other than the storey of fire origin), to not more than 1% by volume for a period of 2 hours assuming an outdoor temperature equal to the January design temperature on a 2.5% basis [3.2.6.2.(2)]. These smoke contamination limits also apply to exit stair shafts and firefighters elevator shafts [3.2.6.2.(3) and (4)].

Supplementary Standard SB-4 describes a series of measures that are deemed to achieve the performance required by 3.2.6.2.

While the measures are described in prescriptive terms for application, it is noted that these measures do not prohibit the use of other designs that, in the opinion of the Chief Building Official, satisfy the required performance levels.

Objectives

Upon completion of this module, you will be able to:

- identify building characteristics that direct the use of specific measures.
- understand the principal requirements of specific measures.
- apply appropriate measures to buildings.

9.2 OVERVIEW

Section 1 of SB-4 contains requirements applicable to both the design of new buildings and to the renovation of existing buildings. Explanatory material in Section 1 corresponding to Sentence 3.2.6.2.(1) describes requirements applicable to the renovation of existing sprinklered buildings. The material in Section 1 corresponding to 3.2.6.2.(2) contains specific requirements which are intended to be applied to the renovation of existing buildings that are not sprinklered.

Building Code provisions in Section 1 are identified numerically. For example, Provision (6) of 3.2.6.2.(1) relate to existing sprinklered buildings.

The measures are identified alphabetically in Sections 2 and 3 of SB-4, based on their principal distinctive design elements intended to address high building fire safety:

A	fully sprinklered building
B, C	open corridor access to stairs and elevators
D, E	protected vestibule access to stairs and elevators
F, G	pressurized stairs and elevators
H	building fully pressurized
I, J	partially pressurized building
K	vertically divided building
L	areas of refuge
M	building with balconies
N	connected buildings

In general, measures intended for buildings of unlimited major occupancy, height and occupant load contain additional requirements for limiting smoke spread to other storeys (typically via vertical service spaces) in conjunction with staged evacuation strategies for the building.

Conversely, buildings with limited major occupancy, height and occupant loads have fewer requirements to limit smoke movement to other floors while assuming simultaneous evacuation of all storeys in a fire emergency. Limitations, where applicable, are described in Section 2 of SB-4.

In general, high building measures that limit smoke movement assist to:

- reduce smoke movement to parts of the building beyond the area of origin,
- preserve tenability of common evacuation routes serving occupants,
- maintain areas of occupant refuge (defend-in-place strategies), and
- facilitate safe firefighters access to a fire in the building.

Section 2 also identifies requirements of Subsection 3.2.6 that are applicable in conjunction with all of the measures described in SB-4.

EXERCISE #9-1

Take 10 minutes to read SB-4 "Introduction" and the first 3 pages of Section 2 "Scope of Measures for Fire Safety in Existing High Buildings" and answer the following question:

1. Which of the following are common requirements for all of the high building measures described in SB-4:

	Yes	No
Key operated elevator recall -	_	_
Firefighters' elevator -	_	_
Venting of floor areas to aid firefighters -	_	_
Certain floor areas to be sprinklered -	_	_
Limits on interior finish flame spread rating / smoke developed classification -	_	_
Central alarm and control facility -	_	_
Voice communication in buildings exceeding 36 m height -	_	_
Fire protection of emergency equipment power conductors -	_	_
Emergency power for fire alarm, voice communication and lighting -	_	_
Emergency power for elevators in buildings exceeding 36 m height -	_	_

STOP

9.3 DETAILED DESCRIPTION OF MEASURES (Sections 2 and 3)

Section 3 of SB-4 provides an expanded description of the requirements summarized in Section 2 of SB-4. Refer to the illustrations in Section 2 when using Section 3.

This section of the module summarizes the design elements of each measure. It will be observed that some requirements are common to more than one measure.

Measure A: Fully Sprinklered Building

Measure A applies to high buildings with the following characteristics:

- fully sprinklered
- no limit on major occupancy
- no limit on building height.

This measure utilizes the building sprinkler system to control fire growth and hence, smoke development. It is noted that construction requirements of Subsection 3.2.2 require many high buildings to be sprinklered, therefore this is a commonly applied measure for sprinklered buildings.

In conjunction with sprinklers, additional measures include:

- Stairs serving storeys above the lowest exit storey are separated from stairs serving storeys below the lowest exit storey with a fire separation having a fire resistance rating equal to that required for the stair shafts. During a fire emergency, the stair shaft above the lowest exit storey is vented to the exterior near the bottom. The stair shaft below the lowest exit storey is mechanically pressurized near the bottom and vented to the exterior near the top of the shaft. Pressurization ducts are protected from fire exposure within the building [3A(2), (3), (4), (7)].

- Elevator shafts (including firefighters' elevators) penetrating the floor above the lowest exit storey and more than 1 storey below the lowest exit storey are provided with fire rated vestibules at all storeys below the lowest exit level [3A(5)]. The fire-resistance rating of the vestibule is dependant on the characteristics of the adjacent floor area:

Adjacent Space (below lowest exit storey)	Vestibule Fire-resistance Rating (h)	Measure/Code Reference
Public corridor	3/4	[3D(3)(a)]
Remainder of floor area	Same as required for exit	[3D(3)(b); 3.4.4.1]
Stair shaft	Same as required for exit	[3D(3)(c); 3.4.4.1]
Elevator enclosure	Same as required for exit	[3D(3)(c); 3.4.4.1]

- Vertical service spaces, other than elevator shafts are vented to the exterior at the top of the shaft, or are firestopped or fitted with a noncombustible seal at the floor level of the storey immediately below the lowest exit storey [3A(6)]

- The building central alarm and control facility is provided with manual controls to initiate stair mechanical air supply, open shaft vents and stop air handling systems as required by Article 3.2.6.7. [3A(8)].

STOP

Measures B and C:
Open Corridor Access to Stairs and Elevators

Measure B and C apply to buildings designed with corridors vented to the exterior when serving as access to stairs and elevators.

Measure B includes vertical service space and shaft restrictions to limit smoke movement between storeys and is applicable to all buildings regardless of major occupancy and height.

Measure C does not include additional provisions to limit smoke movement between storeys through vertical service spaces of shafts, and is applicable only to buildings:

- of Group A, C, D, E or F major occupancy,
- not exceeding 75 m in height to the floor level of the top storey, and
- in which the area of exit stair treads and landings (in m^2) is at least 3.6 times greater than the occupant load of storeys above grade [SB-4, Section 1, 3.2.6.2.(6) Provision (6)].

Requirements include:

- Stairs serving storeys above the lowest exit storey are separated from stairs serving storeys below the lowest exit storey with a fire separation having a fire resistance rating equal to that required for the stair shafts. During a fire emergency, the stair shaft below the lowest exit storey is mechanically pressurized near the bottom and vented to the exterior near the top of the shaft. Pressurization ducts are protected from fire exposure within the building [3B(3), (8); 3C(3), (6)].

- Elevator shafts (including only firefighters' elevators for application of Measure C) penetrating the floor above the lowest exit storey and more than 1 storey below the lowest exit storey are provided with fire rated vestibules at all storeys below the lowest exit level [3B(4); 3C(4)]. The fire-resistance rating of the vestibule is dependant on the characteristics of the adjacent floor area:

Adjacent Space (below lowest exit storey)	Vestibule Fire-resistance Rating (h)	Measure/Code Reference
Public corridor	3/4	[3D(3)(a)]
Remainder of floor area	Same as required for exit	[3D(3)(b); 3.4.4.1]
Stair shaft	Same as required for exit	[3D(3)(c); 3.4.4.1]
Elevator enclosure	Same as required for exit	[3D(3)(c); 3.4.4.1]

- For application of Measure B only, vertical service spaces (other than elevators) in heated floor areas are vented to the exterior at the top of the shafts. Alternately, the vertical service space may be firestopped at maximum 5 storey intervals with one of the firestops in the floor assembly immediately below the lowest exit storey [3B(5)].

- Air moving fans for air handling systems serving more than 2 storeys are stopped during a fire emergency. For application of Measure B only, ducts in these systems are equipped with fire dampers designed to close when the fans are stopped if the duct cross-sectional area exceeds 0.013 m^2 where the duct penetrates a vertical service space enclosure [3B(6), (7); 3C(5)].

- The central fire alarm and control facility is provided with manual controls to initiate stairshaft air supplies, open vents at tops of vertical service spaces, stop air moving fans and close dampers as required above [3B(9); 3C(7)].

STOP

Measures D and E: Protected Vestibule Access to Stair and Elevator Shafts

Measures D and E apply to buildings designed with protected vestibule access to stairs and elevators. Vestibules limit smoke movement in the building by improving the isolation of floor areas that may be fire locations from vertical shafts that provide egress or can be primarily responsible for vertical smoke movement.

Measure D is applicable to all buildings regardless of major occupancy and height.

Measure E does not include additional provisions to limit smoke movement between storeys and is applicable to only buildings:

- of Groups A, C, D, E or F major occupancy,
- not exceeding 75 m in height to the floor level of the top storey, and
- in which the area of exit stair treads and landings (in m^2) is at least 3.6 times greater than the occupant load of storeys above grade [SB-4, Section 1, 3.2.6.2.(6) Provision (6)].

Requirements include:

- Stairs serving storeys above the lowest exit storey are separated from stairs serving storeys below the lowest exit storey with a fire separation having a fire resistance rating equal to that required for the stair shafts. During a fire emergency, the stair shaft above the lowest exit storey is vented to the exterior near the bottom. The stair shaft below the lowest exit storey is mechanically pressurized near the bottom and vented to the exterior near the top of the shaft. Pressurization ducts are protected from fire exposure within the building [3D(7), (8), (16); 3E(6), (7), (12)].

- Stair and elevator shafts are accessed via vestibules constructed as fire separations having fire resistance ratings as follows:

Adjacent Space	Vestibule Fire-resistance Rating (h)	Measure/Code Reference
Public corridor	3/4	[3D(3)(a)]
Remainder of floor area	Same as required for exit	[3D(3)(b); 3.4.4.1]
Stair shaft	Same as required for exit	[3D(3)(c); 3.4.4.1]
Elevator enclosure	Same as required for exit	[3D(3)(c); 3.4.4.1]

Vestibules are also vented to the exterior or mechanically pressurized during a fire emergency. Elevator shafts with pressurized vestibules require relief venting to the exterior near the bottom of the shaft [3D(2), (3), (5), (9), (10); 3E(2), (3), (4), (5), (8), (9)].

Note: This requirement does not apply to elevators serving only the lowest exit storey and floors below (e.g. parking garage shuttle elevator) [3D(12), (13)].

- For application of Measure D only, vertical service spaces (other than elevators) are vented to the exterior at the top of the shafts. Alternately, the vertical service space may be firestopped at maximum 5 storey intervals with one of the firestops in the floor assembly immediately below the lowest exit storey [3D(11)].

- Air moving fans for air handling systems serving more than 2 storeys (except vestibule pressurization fans) are stopped during a fire emergency. For application of Measure D only, ducts in these systems are equipped with fire dampers designed to close when the fans are stopped if the duct cross-sectional area exceeds 0.013 m^2 where the duct penetrates a vertical service space enclosure [3D(14), (15); 3E(11)].

- The central fire alarm and control facility is provided with manual controls to initiate vestibule air supplies, open vents for vestibules, elevator shafts and at tops of vertical service spaces, stop air moving fans and close dampers as required above. [3D(17); 3E(13)].

STOP

Measures F and G: Pressurized Stair and Elevator Shafts

Measures F and G apply to buildings designed with stair and elevator shafts that are pressurized during fire emergencies. Pressurizing the shafts reduce the likelihood of vertical smoke movement in the building via these spaces.

Measure F is applicable to all buildings regardless of major occupancy and height.

Measure G does not include additional provisions to limit smoke movement into upper floors by way of service shafts, and is applicable only to buildings:

- of Groups A, C, D, E or F major occupancy,
- not exceeding 75 m in height to the floor level of the top storey, and
- in which the area of exit stair treads and landings (in m^2) is at least 3.6 times greater than the occupant load of storeys above grade [SB-4, Section 1, 3.2.6.2.(6), Provision (6)].

Requirements include:

- Stairs serving storeys above the lowest exit storey are separated from stairs serving storeys below the lowest exit storey with a fire separation having a fire resistance rating equal to that required for the stair shafts. During a fire emergency, the stair shaft above the lowest exit storey is vented to the exterior near the bottom. The stair shaft below the lowest exit storey is mechanically pressurized near the bottom and vented to the exterior near the top of the shaft. Pressurization ducts are protected from fire exposure within the building [3F(2), (3), (13); 3G(2), (3), (8)].

- Storeys below the lowest exit storey are vented to the exterior where a fire fighters elevator shaft penetrates the floor of the storey below the lowest exit storey. Venting may be conducted through conventional exhaust duct systems [3F(6); 3G(6)].

- Firefighters' elevator shafts are pressurized during a fire emergency. Supply air ducts are protected from fire exposure within the building [3F(4), (13), 3G(4), (8)].

- For application of Measure F only, non-firefighters' elevator shafts are also pressurized during a fire emergency, except that shafts serving floors below the lowest exit storey and that do not penetrate the floor above the lowest exit storey (e.g. parking shuttle elevator) are exempt [3F(8), (9)].

- For application of Measure F only, vertical service spaces (other than elevators) are vented to the exterior at the top of the shafts. Alternately, the vertical service space may be firestopped at maximum 5 storey intervals with one of the firestops in the floor assembly immediately below the lowest exit storey [3F(7)].

- Air moving fans for air handling systems serving more than 2 storeys (except stair and elevator pressurization fans) are stopped during a fire emergency. For application of Measure F only, ducts in these systems are equipped with fire dampers designed to close when the fans are stopped if the duct cross-sectional area exceeds 0.013 m^2 where the duct penetrates a vertical service space enclosure [3F(11), (12), 3G(7)].

- The central fire alarm and control facility is provided with manual controls to initiate air supply to stair and elevator shafts, open vents at tops of vertical service spaces, stop air moving fans and close dampers as required above [3F(14); 3G(9)].

STOP

Measure H: Fully Pressurized Building

Measure H is suitable for buildings of any height and major occupancy with a central core of stair and elevator shafts and normally closed windows. In a fire emergency, the entire building is pressurized and the fire floor is vented to the exterior. Openings in the exterior walls and roof are closed.

Requirements include:

- Utilization of the building air handling system to supply air into the building, including stairshafts, during a fire emergency. This is achieved by stopping main return and exhaust fans, but operating supply fans, with controls at the CACF. Pressurization ducts are to be protected from fire exposure within the building [3H(2), (4), (8), (9)].

- Return and exhaust air ducts are equipped with dampers designed to close when the fans are stopped if the duct cross-sectional area exceeds 0.013 m^2 where the duct penetrates a vertical service space enclosure. Dampers need not close on the floor of fire origin where a duct system is used for venting purposes [3H(6), (7)].

- Venting the floor of fire origin to the exterior. Venting may consist of openable windows or wall panels, smoke shaft or the building air handling system (in a sprinklered building) [3H(7)].

- Discharging exit stairs to the exterior via pressurized vestibules constructed as fire separations with fire resistance ratings as follows [3H(3)].

Adjacent Space (below lowest exit storey)	Vestibule Fire-resistance Rating (h)	Measure/Code Reference
Public corridor	3/4	[3D(3)(a)]
Remainder of floor area	Same as required for exit	[3D(3)(b); 3.4.4.1]
Stair shaft	Same as required for exit	[3D(3)(c); 3.4.4.1]
Elevator enclosure	Same as required for exit	[3D(3)(c); 3.4.4.1]

- Openings in exterior walls and roof can be closed with controls located at the CACF [3H(5), (9)].

- The central fire alarm and control facility is provided with manual controls to stop supply and return air fans, maintain supply air, close dampers to vertical service spaces and open vents on a fire floor as required above [3H(9)].

STOP

Measures I and J:
Partially Pressurized Building

Measures I and J are based on the supply of air to central core stair shafts, elevator shafts and connecting corridors to limit smoke movement into these spaces and thereby to other storeys.

Measure I is intended for buildings of any height containing any major occupancy.

Measure J does not include additional provisions to limit smoke movement into upper floors by way of vertical shafts and ducts outside the core and is applicable only to buildings:

- of Group A, C, D, E or F major occupancy,
- not exceeding 75 m in height to the floor level of the top storey, and
- in which the area of exit stair treads and landings (in m^2) is at least 3.6 times greater than the occupant load of storeys above grade [SB-4, Section 1, 3.2.6.2.(6) Provision (6)].

Requirements include:

- Use of building air handling systems to supply air to exit stair shafts, firefighters elevator shafts and public corridors. Supply air ducts are protected from fire exposure within the building [3I(2), (9); 3J(2), (5)].

- Vertical service spaces within the pressurized core are equipped with closures at points of penetration between the core and non-pressurized spaces in the building, and at any openings from the tops of service spaces to the exterior. The closures are designed to be controlled form the central alarm and control facility [3I(3), (10); 3J(3), (6)].

- For application of Measure I only, vertical service spaces not within the pressurized core are firestopped at the floor level of the storey immediately below the lowest exit storey and at maximum 5 storey intervals. Alternately, the service spaces may be vented to the exterior [3I(6)].

- For application of Measure I only, each non-pressurized floor area can be vented to the exterior with openable windows or panels, smoke shaft or building exhaust system [3I(4), (5)].

Air moving fans for air handling systems serving more than 2 storeys (except core supply fans) are stopped during a fire emergency. For application of Measure I only, ducts in these systems are equipped with fire dampers designed to close when the fans are stopped if the duct cross-sectional area exceeds 0.013 m^2 where the duct penetrates a vertical service space enclosure [3I(7), (8); 3J(4)].

- The central fire alarm and control facility is provided with manual controls to maintain air supply to core stair shafts, elevator shafts and corridors; stop other air handling fans, operate service space dampers, and operate venting for non-pressurized floor areas on a floor-by-floor basis as applicable [3I(10); 3J(6)].

STOP

Measure K: Vertically Divided Building

Measure K is based on vertically subdividing a building by either fire separation or spatial separation. The intent is to limit smoke spread horizontally in the building to enable horizontal egress from a contaminated zone to an uncontaminated smoke control zone provided with access to exits, and from elevators, that do not serve the contaminated smoke control zone.

Measure K is intended for buildings of any height containing A, C, D, E or F major occupancies.

Requirements include:

- Vertical subdivision of floor areas into two smoke control regions with fire separations having fire resistance ratings equal to that of the floor assembly, or by external spatial separation in accordance with Subsection 3.2.3. [3K(2), (15)].

- Pedestrian connections between smoke control regions are provided via vestibules or bridges. Vestibules/ bridges are required at maximum 5 storey intervals, except that they are required at each storey when serving residential buildings more than 75 m high. Vestibules/bridges are separated from each smoke control region with a fire separation having a fire resistance rating equal to that of exits, except that a 45 minute fire separation is adequate for connection to a public corridor. Vestibules/bridges are vented to the exterior or pressurized during a fire emergency. Supply air ducts are protected from fire exposure within the building [3K(3), (8), (9), (11), (16)].

- The width of stairs and ramps providing access to floor areas having vestibules or bridges are to be based on the factor of 5.5 mm/person. The width of vestibules/bridges and connecting corridors and doors on the same storey as a vestibule/bridge are to be based on the factor of 3.67 mm/person. Doors opening into vestibules or bridges are to be identified as leading to an area of refuge [3K(6), (7), (10)].

- The floor area on each side of a vestibule or bridge is sized to accommodate its own occupant load plus the occupant load of the adjacent smoke control region through 1 – 5 storeys (depending on vestibule/bridge vertical intervals). Occupant load within an area of refuge is based on the factors 0.5 m^2/ambulatory person and 1.5 m^2/non-ambulatory person [3K(5)].

- Floor areas in each smoke control region are provided with at least 1 exit and 1 firefighters' elevator that is independent of another smoke control region. All exit stairs are vented to the exterior near the lowest exit level [3K(4), (13)].

- Where smoke control regions are separated by fire separations (as opposed to external spatial separation), each floor below the mid-height of each smoke control region (mid-height of building on each side of fire separation) is provided with a minimum 1.5 m^2, manually operated, vent to the exterior [3(12)].

- Air moving fans for air handling systems serving more than 2 storeys (except vestibule or bridge supply fans) are stopped during a fire emergency [3K(14)].

- The central fire alarm and control facility is provided with manual controls to initiate vestibule/bridge air supply, close vestibule/bridge doors (if normally held open), and stop air moving fans as applicable [3K(17)].

STOP

Measure L: Areas of Refuge

Measure L is based on providing occupants with areas of refuge within the building.

Measure L is considered suitable for buildings of any height containing A, C, D, E or F major occupancies.

Requirements include:

- The building is provided with 2 separate groups of areas of refuge. Each area of refuge group provides areas of refuge at maximum 5 storey intervals, and each area of refuge within the group is connected by a common exit stair [3L(2)].

- Areas of refuge are separated from the remainder of floor areas with fire separations having fire resistance ratings equal to exits, except that 45 minutes is adequate at a public corridor [3L(7), (8)].

- Each area of refuge is provided with a mechanical air supply during a fire emergency. Supply ducts are protected from fire exposure within the building [3L(10), (19)].

- The width of stairs and ramps providing access to floor areas having areas of refuge are to be based on the factor of 5.5 mm/person. The width of connecting corridors and doors on the same storey as an area of refuge are to be based on the factor of 3.67 mm/ person. Doors opening into areas of refuge are to be identified as leading to an area of refuge [3L(5), (6), (9)].

- Each group of areas of refuge is sized to accommodate the occupant load of all above grade storeys, served by the area of refuge, based on factors of 0.5 m^2/ambulatory person and 1.5 m^2/non-ambulatory person [3L(4)].

- Stairs serving storeys above the lowest exit storey are separated from stairs serving storeys below the lowest exit storey with a fire separation having a fire resistance rating equal to that required for the stair shafts. During a fire emergency, the stair shaft above the lowest exit storey is vented to the exterior near the bottom. The stair shaft below the lowest exit storey is mechanically pressurized near the bottom and vented to the exterior near the top of the shaft. Pressurization ducts are protected from fire exposure within the building. Exit doors not opening directly into an area of refuge are protected with pressurized vestibules if the stair shaft is not pressurized [3L(11), (14), (15), (19)].

- Firefighters' elevator shaft doors not opening directly into an area of refuge are protected with pressurized vestibules, or the elevator shaft is pressurized. The elevator shaft is vented to the exterior near the bottom of the shaft [3L(11), (12), (16), (17)].

- Any elevator shaft serving storeys above the lowest exit storey, and that passes through the floor of the storey below the lowest exit storey is protected at each floor below the lowest exit storey with a vestibule constructed as a fire separation having the following fire-resistance rating [3L(13)]:

Adjacent Space (below lowest exit storey)	Vestibule Fire-resistance Rating (h)	Measure/Code Reference
Public corridor	3/4	[3D(3)(a)]
Remainder of floor area	Same as required for exit	[3D(3)(b); 3.4.4.1]
Stair shaft	Same as required for exit	[3D(3)(c); 3.4.4.1]
Elevator enclosure	Same as required for exit	[3D(3)(c); 3.4.4.1]

- Air moving fans serving more than 2 storeys (except those supplying air to areas of refuge, vestibules, stair or elevator shafts) are stopped during a fire emergency [3L(18)].
- The central fire alarm and control facility is provided with manual controls to initiate air supply to areas of refuge, vestibules, stair and elevator shafts; close doors to areas of refuge (if normally held open), stop air handling systems and open shaft relief vents as applicable [3L(20)].

STOP

Measure M: Building with Balconies

Measure M applies to existing unsprinklered residential buildings of any height where each suite is provided with an exterior balcony that may be used as naturally vented areas of refuge within each fire compartment.

Requirements include:

- Stairs serving storeys above the lowest exit storey are separated from stairs serving storeys below the lowest exit storey with a fire separation having a fire resistance rating equal to that required for the stair shafts. During a fire emergency, the stair shaft above the lowest exit storey is vented to the exterior near the bottom. The stair shaft below the lowest exit storey is mechanically pressurized near the bottom and vented to the exterior near the top of the shaft. Pressurization ducts are protected from fire exposure within the building [3M(2), (3), (6)].

- Any elevator shaft passing through the floor above the lowest exit storey is protected with pressurized vestibules at all storeys below grade if the elevator shaft penetrates the floor of the storey below the lowest exit storey [3M(4)].

- Air moving fans serving more than 2 storeys (except dwelling unit kitchen, washroom and bathroom exhaust) are stopped during a fire emergency [3M(5)].

- The central alarm and control facility is equipped with manual controls to initiate stair shaft air supply and stop air handling equipment as applicable [3M(7)].

STOP

Measure N: Connected Buildings

Measure N is used to control smoke movement between 2 or more separate buildings where at least one of the buildings is a high building. It is not intended to limit smoke movement within any of the connected buildings. Measure N may be used in conjunction with other measures intended to limit smoke movement within individual buildings.

Application of Measure N is considered to achieve compliance with Article 3.2.6.3.

Requirements include:

- Construction of a firewall (Subsection 3.1.10) between the buildings [3N(2)].
- Protection of firewall openings with a vestibule that is vented to the exterior or provided with a mechanical air supply during a fire emergency [3N(3)].

STOP

EXERCISE #9-2

Take 15 minutes to complete Exercise #9-2. Review answers with your group to obtain consensus.

1. When a measure requires that stair shafts serving storeys above and below the lowest exit storey be separate from each other, the required fire resistance rating of an intervening fire separation is:

   a) 45 minutes
   b) 1 hour
   c) 2 hours
   d) equal to the shaft fire-resistance rating

   ______________________________ [______________]

2. What is the minimum area of a vent to the exterior in a bridge or vestibule constructed to provide access between 2 smoke control regions in a building designed to comply with Measure K?

   ______________________________ [______________]

3. A stair shaft enclosure in a fully pressurized 40 storey building is penetrated with one weatherstripped door at each storey. The required air supply to the shaft during a fire emergency is:

   a) 3.76 m^3/s
   b) 4.42 m^3/s
   c) 5.68 m^3/s
   d) 7.56 m^3/s

   ______________________________ [____________]

4. A high building is designed in conformance with Measure D. An elevator serving storeys from street level to the 24th storey is protected with vestibules with a mechanical air supply in accordance with 3D(5)(b). What is the minimum area of the relief vent required near the bottom of the elevator shaft?

   a) 0.02 m^2
   b) 0.4 m^2
   c) 0.46 m^2
   d) 0.48 m^2

   ____

   ______________________________ [____________]

STOP

9.4 DESIGN REQUIREMENTS FOR CONTROL OF SMOKE MOVEMENT

This section of the module reviews design criteria for some of the more common smoke control methods described in SB-4 and module subsection 8.3 for various high building measures. Design criteria are provided in Sections 2 and 3, and Appendix A of SB-4.

Venting Stair Shafts Above the Lowest Exit Storey

This requirement is applicable to Measures A, D, E, F, G, K, L and M.

It is designed to provide an openable area at, or near, the bottom of the shaft based of 0.05 m^2/door between the stair shaft and adjacent floor areas, but not less than 1.8 m^2 [3A(4)]. Exterior doors equipped with hardware to hold the door in an open position are frequently used to vent these shafts.

Example:

Calculate the minimum exterior vent area for a stair serving 20 storeys. The shaft contains one door at each storey, with the exception of the first and second storeys, each of which have 2 doors opening into the exit.

Solution:

Number of doors = (18 storeys x1 door) + (2 storeys x 2 doors) = 22 doors

Vent area = 22 doors x 0.05 m^2/door = 1.1 $m^2 < 1.8$ m^2

Therefore, provide a vent with minimum 1.8 m^2 area.

Pressurizing Stair Shafts Above the Lowest Exit Storey

In Measures F and G, the stair venting described above is augmented with stair pressurization [3F(2); 3G(2)(b)]. The stair supply is required to be at least:

> $4.72 \text{ m}^3/\text{s} + 0.094 \text{ m}^3/\text{s}$ for every door opening into the stair shaft.

Example:

Calculate the minimum vent area and mechanical air supply for a stair serving each above grade storey of a 38 storey building where the stair is accessed with 1 door at each storey and discharges to the exterior at grade.

Solutions:

Vent area = $0.05 \text{ m}^2/\text{door} \times 38 \text{ doors} = 1.9$ [3A(4), 3F(2)]

Air supply = $4.72 \text{ m}^3/\text{s} + (0.094 \text{ m}^3/\text{s}/\text{door} \times 38 \text{ doors}) = 8.3 \text{ m}^3/\text{s}$

Pressurizing Stair Shafts Below the Lowest Exit Storey

This requirement is applicable to Measures A, B, C, D, E, F, G, L and M.

It is designed on the basis of the following [3A(3)] :

- Supply air provided near the bottom of the shaft at a rate of 0.47 m^3/second for each storey served, and
- Relief venting to the exterior near the top of the shaft with an openable area based on:

  0.1 m^2/storey less 0.01 m^2/weatherstripped door or less 0.02 m^2/non-weatherstripped door

Example:

Calculate the mechanical air supply and venting required for a stair serving 5 storeys below the lowest exit storey and having one non-weatherstripped door between the shaft and floor areas at each storey.

Solution:

Air supply = 5 storeys x 0.47 m^3/s/storey = 2.35 m^3/s
Vent area = (5 storeys x 0.1 m^2/storey) – (5 doors x 0.02 m^2/door) = 0.4 m^2

Venting to Aid Firefighters

Venting of floor areas to satisfy Measures H or I, and to comply with Sentence 3.2.6.6.(1) to aid firefighters is addressed in Section 1, [3.2.6.6.(1)] of SB-4. Venting may be accomplished with:

- windows
- wall panels
- smoke shafts, or
- the building mechanical system (in a sprinklered building).

Windows and wall panels used for smoke venting must be:

- uniformly distributed around the building perimeter at each storey,
- have a total area equal to at least 1% of the exterior wall area of each storey,
- be readily identifiable and openable from the interior,
- be readily identifiable from the exterior when accessible to firefighters outside the building,
- designed not to endanger persons outside of the building when opened.

Smoke shafts used for venting must:

- be constructed as fire separations having fire-resistance ratings equal to the ratings of the floor assemblies through which they pass,
- discharge to the exterior at least 900 mm above the roof level,
- contain no combustible materials, fuel lines or services required during emergencies,
- be sized in accordance with Tables 1, 2 and 3 in Section 1, [3.2.6.6.(1)] of SB-4.

Example:

Calculate the smoke shaft cross-sectional area required for a building with the following characteristics:

- 90 m building height
- 3,000 m^2 floor areas
- monolithic concrete smoke shaft construction
- single-blade fire dampers.

Solution:

Using Tables 3 and 4:

Leakage area of shaft wall	0.5% (Table 2)
Leakage area of fire dampers	3.5% (Table 3)
Total leakage area	4.0%

Using Table 2 and the leakage area determined above:

- select Table row based on 3,000 m^2 floor area and 4.0% leakage area
- select Table column based on 90 m height (select column with equal, or greater, building height)

Minimum vent area is identified at the intersection of the appropriate horizontal row and vertical column. In this example, the 3,000 m^2 building area : 4.0% leakage area row and 110 m height column intersect at a point indicating a minimum 6.63 m^2 vent area. Therefore, the vent leading from a floor area to the smoke shaft, the smoke shaft, and the discharge opening from the shaft to the exterior should all be 6.63 m^2 in cross-sectional area.

Vestibule Connecting Buildings

This requirement is applicable to Measure N for connecting passageways joining separate high buildings. Design criteria are specified in 3N(3).

Example:

Calculate the exterior vent area required for a vestibule constructed in the connection between two high buildings. The vestibule has the following characteristics:

- located on grade,
- has four doors at each of two ends leading to adjacent buildings,
- door size is 900 mm x 2200 mm,
- roof height is 3 m above grade; width is 4.5 m and length is 5 m.

Solution:

Door perimeter = 2(0.9 m + 2.2 m) = 6.2 m > 6 m, therefore proportional door factor applies.
Proportional door factor = 6.2/6 = 1.03
Vestibule exterior surface area = 2(3.0 m x 5 m [sides]) + (4.5 m x 5 m[roof]) = 52.5 m^2

$$\begin{aligned}\text{Vent area} &= 10[(0.023d) + (0.00045a)] \\ &= 10[(0.023 \times (1.03 \times 8 \text{ drs})) + (0.00045 \times 52.5 \text{ m}^2)] \\ &= 10[(0.19) + (0.024)] \\ &= 2.14 \text{ m}^2\end{aligned}$$

EXERCISE #9-3

Take 10 minutes to complete Exercise #9-3. Review answers with your group to obtain consensus.

1. A stairway serving 52 storeys above grade is vented to the exterior in accordance with Measure A(2). There is one door to the stairway at each floor level. The required exterior vent area is:

   a) 1.8 m^2
   b) 2.6 m^2
   c) 4.2 m^2
   d) 5.2 m^2

   ---

2. A stairway serving 4 storeys below the lowest exit storey is required to be pressurized for compliance with Measure 2D(8). Calculate the required rate of stair pressurization.

   a) 0.47 m^3/s
   b) 0.20 m^3/s
   c) 0.65 m^3/s
   d) 1.88 m^3/s

   ---

3. If each level of the stair in question (2) has 2 weatherstripped doors, the required exterior vent area is:

   a) 0.24 m^2
   b) 0.32 m^2
   c) 0.36 m^2
   d) 0.40 m^2

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 10

COMPLEX BUILDINGS - 2006

SAFETY WITHIN FLOOR AREAS

BARRIER-FREE DESIGN

10.1 INTRODUCTION (Sections 3.3. and 3.8.)

Section 3.3. deals with safety within floor areas. Subsection 3.3.1. applies to all occupancies in general, whereas Subsections 3.3.2. to 3.3.5. contain requirements that apply only to specific occupancies. This module will deal with:

- Fire separations of occupancies and corridors
- Egress requirements
- Design criteria for doors, corridors, guards
- Protection on floor areas with a B/F Path of Travel
- Special requirements for major occupancies

Section 3.8. deals with Barrier-Free Design.

Objectives

Upon completion of this module, you should be capable of:

- describing the principles underlying measures designed to ensure fire safety within floor areas;
- describing the requirements and need for fire separation of occupancies and corridors;
- locating design criteria for building components regulated in this Section;
- relating the principles underlying measures designed for barrier-free design.

10.2 BARRIER FREE DESIGN

Definitions

The following definitions are taken from Division A, Part 1 of the Code. While italicized in this section, they will not be italicized in the remainder of this module.

Access to exit

Access to exit means that part of a means of egress within a floor area that provides access to an exit serving the floor area.

Floor area

Floor area means the space on any storey of a building between exterior walls and required fire walls including the space occupied by interior walls and partitions, but not including exits, vertical service spaces and their enclosing assemblies. (Refer to the large Buildings - 2006 course for further information)

Fire separation

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

The Appendix note to this definition explains that a fire separation may or may not have a fire-resistance rating. Thus, where the Code waives the fire-resistance rating, the assembly must still function as a fire separation, even if it has a 0 h fire-resistance rating. (Refer to the Large Buildings - 2006 course for further information)

Means of egress

Means of egress includes exits and access to exits and means a continuous path of travel provided for the escape of persons from any point in a building or in a contained open space to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and that has access to an open public thoroughfare.

Public corridor

Public corridor means a corridor that provides access to exit from more than one suite.

The term "corridor used by the public" is not a defined term but is treated similar to a public corridor.

Suite

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories and individual stores and individual or complementary rooms for business and personal services occupancies. Additional explanatory material is available in the Building Code Appendix A-1.4.1.2.

Section Organization

Section 3.3. is divided into five Subsections.

The first, Subsection 3.3.1., deals with requirements that apply to all floor areas.

In dealing with the general requirements that apply to all occupancies, for this portion of the module we have organized these requirements into three categories:

- Fire separations
- Egress requirements from rooms and suites
- Design criteria for egress and building components.

Article 3.3.1.7. deals with protection of floor areas above or below the first storey with a barrier-free path of travel in buildings.

The remaining Subsections 3.3.2. to 3.3.5. each deal with a specific occupancy classification that requires special rules to address their unique characteristics or conditions. These occupancies are:

3.3.2	Assembly Occupancies (i.e. Group A)
3.3.3	Care and Detention Occupancies (i.e. Group B)
3.3.4	Residential Occupancies (i.e. Group C)
3.3.5	Industrial Occupancies (i.e. Group F)

STOP

10.3 FIRE SEPARATIONS

There are three types of fire separations addressed in Section 3.3. They are fire separations of:

- suites of rooms based on major occupancy or tenancy (suites)
- public corridors or corridors used by the public (note: what is normally referred to as a mall is actually a public corridor)
- specific types of rooms, uses related to specific major occupancies.

Separation of Suites

Article 3.3.1.1. is a general requirement that suites shall be separated from adjoining suites by a 1 h fire separation. The Code permits a reduction in the rating to ¾ h for certain buildings [Sentence 3.3.1.1.(2)]. Refer to the Large Building - 2006 course for further information.

- Business and personal service occupancies (Group D) are exempt from this requirement [Sentence 3.3.1.1.(1)].
- The fire separation requirement is waived in a sprinklered building for the following occupancies, if they are served by a public corridor that is more than 9 m in unobstructed width with a ceiling height not less than 4 m, and not more than one-half the required egress doors open into the public corridor (i.e. normally considered a mall) for the entire length of the corridor between exits [Clause 3.3.1.4.(4)(b)]:
    - business and personal service occupancies
    - mercantile occupancies
    - fast food outlets without seating for patrons
    - any combination of the above.

Separation of Public Corridors

Article 3.3.1.4. requires public corridors to be separated from the remainder of the building by a fire separation having a ¾ h fire-resistance rating. There are various exceptions to this general rule. Read Sentences 3.3.1.4.(3) to (5) and Sentence 3.3.1.9.(6). Refer to the Large Buildings - 2006 course for further information.

Separation of Corridor Used by the Public

For certain types of major occupancies, like assembly occupancies and care and detention occupancies, the building or floor area is occupied by a single tenant. The corridors that function as a means of egress for these floor areas do not fit into the strict definition of public corridor. The Code addresses these corridors in Subsections 3.3.2. and 3.3.3. that deal with specific life safety requirements that are unique to certain major occupancies. The Code refers to these corridors as 'corridors used by the public'. This term is not a defined term. These corridors function and serve the same purpose as public corridors. Throughout the Code, particularly in Section 3.4., "Exits", you will find that both types of corridors are referred to and generally are treated equally (i.e. what applies to one can be applied to the other). Refer to the Large Buildings - 2006 course for further information.

STOP

EXERCISE #10-1

Take 5 minutes to complete the following questions. Give the Code references where applicable.

1. In a multi-tenant building regulated by Article 3.2.2.55., the floor assemblies are constructed of noncombustible construction without a fire-resistance rating. What fire separation is required for the public corridors that are 2 m wide?

   a) 0 h smoke separation
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation required

   ____

   __________________________[______________]

2. A public corridor in a sprinklered commercial mall is 9 m wide and complies with Clause 3.3.1.4.(4)(b). What is the fire separation requirement for the demising wall between the tenant spaces that are occupied as business and personal service or mercantile occupancies?

   a) 0 h smoke separation
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation

   ____

   _________________________[____________]

3. In a sprinklered high-rise apartment building regulated by Article 3.2.2.42., what is the fire separation requirement between the public corridor and the dwelling units?

   a) 0 h smoke separation
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation required

   ____

   _________________________[____________]

4. A public corridor serves a dwelling unit and four offices on the second floor of a three storey unsprinklered commercial building with five offices on the third floor. Each tenant space is 200 m^2. The building is regulated by Articles 3.2.2.53. and 3.2.2.46. What fire separation is required for the public corridor on the third floor?

   a) 0 h if of noncombustible construction
   b) ¾ h fire separation
   c) 1 h fire separation

d) no separation required

____

______________________ [__________]

STOP

Corridor Separations for Specific Major Occupancies

Assembly Occupancies

Article 3.3.2.5. of the Code commences with the general requirement that a corridor used by the public in an assembly occupancy must be separated from the remainder of the building by a fire separation having a 1 h fire-resistance rating. Exceptions or reduced ratings may apply as for public corridors. Refer to the Large Buildings - 2006 course for further information.

Care and Detention Occupancies

These occupancies have unique requirements due to the specialized nature of their operation.

Fire Separations for Specific Uses

There are specific types of rooms or uses that the Code addresses individually. Janitors' rooms and common laundry rooms are addressed in the general requirements of Subsection 3.3.1. [Articles 3.3.1.20. and 3.3.1.21.].

Other uses, such as rooms in theatres, with seating over 200 persons, an auto repair shop in a school, contained use areas, patient rooms in hospitals and nursing homes, multi-storey dwelling units in a residential building, storage rooms in residential occupancies, repair garages and storage garages, are addressed under the major occupancy requirements in Subsections 3.3.2. to 3.3.5.

A contained use area shall be separated from the remainder of the building by a 1 h fire separation [Sentence 3.3.3.7.(2)].

Except as noted below, a building with a contained use area shall be sprinklered [Sentence 3.3.3.7.(3)].

Sprinklers are not required if the contained use area is located in a building that is not required to be sprinklered by Articles 3.2.2.20. to 3.2.2.83. and:

- the contained use area and the remainder of the building are separated from one another by a 1 h smoke and fire separation such that during a period of 2 hours after the start of a fire in the contained use area or another part of the building, the other fire compartments and the contained use area will not contain more than 1% by volume of contaminated air [3.3.3.7.(2) and 3.3.3.7.(4)(a) and (b)],

- all egress doors are designed to be remotely released as per Sentence 3.3.1.12.(6), and

- the contained use area does not contain any rooms lined with combustible padding [Clause 3.3.3.7.(4)(d)].

STOP

EXERCISE #10-2

Review Subsections 3.3.2. to 3.3.5., and 3.6.2. and answer the following questions.

1. In a high-rise apartment building, there is a common locker/storage area for the tenants on the ground floor. The room must be:

   a) sprinklered
   b) fire separated from the remainder of the building by a 1 h fire separation
   c) both (a) and (b)
   d) fire separated from the public corridor by a ¾ h fire separation.

   ____

   ____________________ [__________]

2. What fire separation is required between a cafeteria with seating for 250 students, and a kitchen, in a sprinklered secondary school?

   a) 30 min
   b) ¾ h fire separation
   c) 1 h fire separation
   d) 2 h fire separation
   e) no separation required

   ____

   ____________________ [__________]

3. What fire separation is required between a parking garage and an adjacent sprinklered garbage room in an apartment building?

   a) ¾ h fire separation
   b) 1 h fire separation
   c) 1½ h fire separation
   d) 2 h fire separation
   e) no separation required

STOP

The following Table 10-1 provides a summary of the fire separation requirements between different suites and rooms, with Code references.

TABLE 10-1

Minimum Required Fire Separation Rating Between Different Suites and Rooms

Room or Suite	Minimum Rating of Fire Separation		Code References
	Sprinklered	Unsprinklered	
1. Between any occupancy and A-1 major occupancy where occupant load exceeds 200 and floor rating is 1 h	1 h (45 min if floor not > 45 min	1 h (45 min if floor not > 45 min	3.3.2.2.(1) & (2) 3.1.3.2.(1)*
2. Between usable space under tiers of seats in an arena	0 h	45 min	3.3.2.2.(3)
3. Library book storage area greater than 250 m^2	0 h	2 h	3.3.2.11.(1)+(2)
4. Between a common laundry room in an apartment building and the rest of the floor area	0 h	1 h (45 min if floor not > 45 min	3.3.1.21.(1) & (2)+(3)
5. Between separate residential apartments	1 h (45 min if floor not > 45 min	1 h (45 min if floor not > 45 min	3.3.1.1.(1) 3.3.4.2.(1), (2)
6. Common storage rooms (not in a suite) on each floor of an apartment building where floor rating is 1 h	1 h (45 min if floor not > 45 min	prohibited	3.3.4.3.(1)+(2)+(3)
7. Between stores in a strip plaza having a 45 min first floor fire separation	45 min	45 min	3.3.1.1.(2)
8. Between suites in multi-tenant industrial occupancies	1 h (45 min if floor not > 45 min	1 h (45 min if floor not > 45 min	3.3.1.1.(1) & (2)
9. Between repair garage and other non-ancillary occupancies	2 h	2 h	3.3.5.5.(1)
10. Between storage garage and other occupancies	1.5 h	1.5 h	3.3.5.6.(1)
11. Between a garbage room without chute and the remainder of the building	1 h	prohibited	3.6.2.5.(1)
12. Between a garbage room with chute and the remainder of the building	2 h	prohibited	3.6.3.3.(6) 3.6.3.3.(9)

* A, mix with F-1 prohibited

10.4 MEANS OF EGRESS AND EGRESS DOORWAYS

The terms 'means of egress', 'access to exits' and 'exits' are often confused. Means of egress is the entire route from within a floor area to the exterior of the building, whereas access to exit is made up of the components of the route from within the floor area to an exit such as the egress door, corridor, ramps, stair, etc. that comprises the means of egress.

Exit is generally an exit stair shaft, a door to an exit stair shaft or to the exterior, or a door through a firewall leading to a separate building. It is important to remember that when the Code refers to an egress door, it is not necessarily referring to an exit door.

The primary function of both means of egress and access to exit is to ensure that occupants of a building are provided with a safe path of travel out of a room, floor area or building in any emergency condition. Subsection 3.3.1. outlines the requirements for providing one or more means of egress from rooms and suites of rooms from within floor areas.

For a floor area that contains more than one suite except in a dwelling unit in a building conforming to 3.2.2.44.(1)(a)(ii) [3.3.4.4.(9)], the access to exit from the room or suite shall be a doorway or doorways that:

- open directly to the exterior, or
- into a public corridor, or
- to an exterior passageway [3.3.1.3.(8)].

Except for dead-end corridors or where otherwise permitted by the Code, where the door enters the public corridor or exterior passage, it shall be possible to go in opposite directions to two separate exits [3.3.1.3.(9)].

Egress From Rooms or Suites

Article 3.3.1.5. specifies the requirements for egress doors from rooms or suites of rooms. Except for dwelling units, the general rule is that a minimum of two egress doors located remote from one another (the separation distance is not specifically regulated but there are rules of thumb that can be used) are required from every room or suite, based on the following criteria:

- The room or suite is occupied as a high hazard industrial occupancy or is a hazardous room and is more than 15 m^2 in area.

- It is intended for an occupant load of more than 60 persons.

- In a floor area that is not sprinklered, the room or suite exceeds the area or the travel distance in Table 3.3.1.5.A.

- If the room is a hazardous classroom in an elementary or secondary school and exceeds 100 m^2 in area.

TABLE 3.3.1.5.A
Egress in Floor Area not Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy of Room or Suite	Maximum Area of Room or Suite, m^2	Maximum Distance to Egress Doorway, m
Group A	150	15
Group C	150 (1)	25 (1)
Group D	200	25
Group E	200	25
Group F, Division 2	200	25
Group F, Division 3	200	25

Notes to Table 3.3.1.5.A:

(1) See Article 3.3.4.4. for dwelling units

- In a floor area that is sprinklered, the room or suite is greater than the area in Table 3.3.1.5.B or the travel distance to an egress door exceeds 25 m, and does not contain an F1 occupancy.

Refer to Figure 10-1 for requirements describing egress from a mezzanine.

TABLE 3.3.1.5.B
Egress in Floor Area Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy of Room or Suite	Maximum Area of Room or Suite, m^2	3.3.1.5.(2)(d) Travel Distance exceeds, m
Group A	200	25
Group B, Division 1	100	25
Group B, Division 2		
sleeping rooms	100	25
other than sleeping rooms	200	25
Group C	150 [1]	25[1]
Group D	300	25
Group E	200	25
Group F, Division 2	200	25
Group F, Division 3	300	25

Notes to Table 3.3.1.5.B:

[1] See Article 3.3.4.4. for dwelling units

Note: Where more than one egress door is required from a room or suite, the travel distance to the nearest door shall not exceed the travel distances specified in Clauses 3.4.2.5.(1)(a), (b), (c) and (f) for exits [3.3.1.6.(1)]. The 25 m requirement for determining the need for the additional egress door does not apply.

Egress From Mezzanines

There are specific egress requirements for mezzanines that are similar but different from the general requirement for rooms or suites [see Sentences 3.3.1.5.(2) and (3)].

Except for mezzanines within dwelling units, these requirements apply to mezzanines that are not required to terminate at a vertical fire separation by Article 3.2.8.2. (see Figure 10-2).

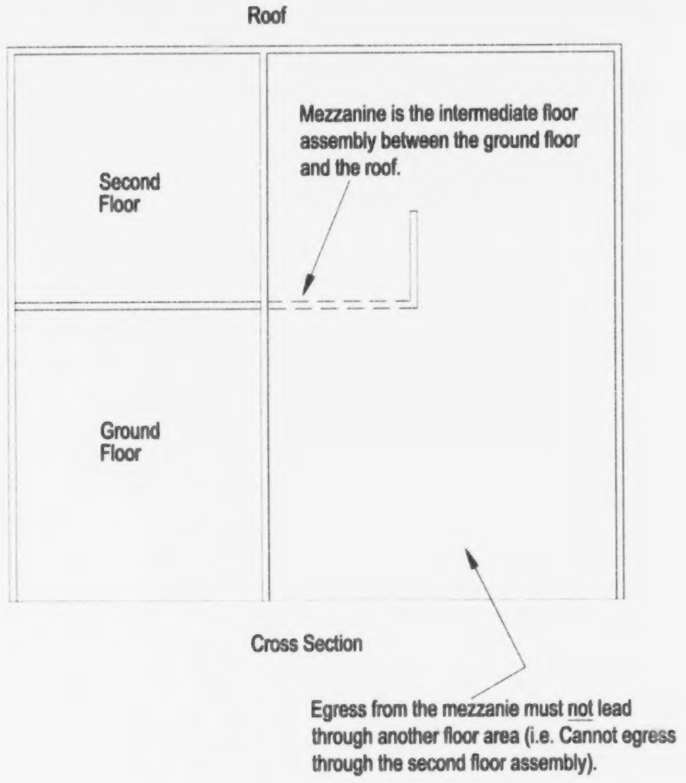

Roof
Second Floor
Ground Floor
Mezzanine is the intermediate floor assembly between the ground floor and the roof.
Cross Section
Egress from the mezzanie must not lead through another floor area (i.e. Cannot egress through the second floor assembly).

FIGURE 10-1

Mezzanine - Plan View

2 egress facilities required if:

- Group F, Division 1 major occupancy
- Occupant load of mezzanine > 60 persons
- Unsprinklered floor area - area or travel distance exceeds requirements in Table 3.3.1.5.A
- Sprinklered floor area - area exceeds requirements in Table 3.3.1.5.B or travel distance > 25m.

FIGURE 10-2

Two egress facilities located remote from one another are required from mezzanines that:

- serve a Group F, Division 1 major occupancy,
- contain an occupant load of more than 60 persons,
- in a floor area that is not sprinkered, exceeds the area or travel distance requirements in Table 3.3.1.5.A, or
- in a floor area that is sprinkered, exceeds the area requirements in Table 3.3.1.5.B, or the travel distance exceeds 25 m [Sentence 3.3.1.5.(2)].

The travel distance is measured from any point on the mezzanine to the egress door of the room in which it is located, where the room is permitted to have a single egress door, and to the top of the stair serving the mezzanine where the room in which it is located is required to have more than one egress door [Sentence 3.3.1.5.(3)].

Egress from Dwelling Units

There are specific requirements for egress from dwelling units. These requirements are outlined in Article 3.3.4.4.

A dwelling unit is permitted to have a single exit door regardless of size or travel distance, provided the exit is an exterior doorway not more than 1500 m above adjacent ground level, and it is not necessary to travel up or down more than one storey to reach the exit door, or the uppermost storey has a balcony not more than 6 m above the adjacent ground level [Sentence 3.3.4.4.(3)].

Except for a dwelling unit in a 4 storey noncombustible building conforming to 3.2.2.44.(1)(a)(ii) where a single storey dwelling unit does not have access to a public corridor or exterior passageway on the same storey, it shall be served by a private stairway (i.e. located within the dwelling unit) leading directly to a public access to exit (i.e. generally a public corridor) on the storey immediately above and immediately below [Sentence 3.3.4.4.(1)].

Except for 4 storey noncombustible buildings conforming to 3.2.2.44.(1)(a)(ii) dwelling units containing more than one storey, except as noted below, an exit door or egress door opening into a public access to exit is required serving the uppermost storey and the lowest storey so that each storey is served by an egress door located not more than 1,500 mm above or below its floor level [Sentence 3.3.4.4.(2)].

The exceptions to the two egress door requirement for multi-level dwelling units are outlined in Sentences 3.3.4.4.(4) and (5).

Egress From Special Areas

Article 3.3.1.3. contains the egress requirements for special areas such as occupied roof spaces, terraces or podiums, rooftop enclosures, service rooms and service space.

Roofs, terraces or podiums that are accessible or occupied by the general public have requirements for egress similar to rooms within the building. Where the occupant load exceeds 60 persons, two separate means of egress are required. [3.3.1.3.(4)]

For rooftop enclosures, mechanical penthouses, service spaces or service rooms, two means of egress or points of egress are required if the room or space exceeds 200 m^2 in area or if the travel distance exceeds 25 m to the point of egress.

STOP

EXERCISE #10-3

1. An office suite in a Group D sprinklered building will require two means of egress when:

   a) the suite is greater than 100 m^2 in area
   b) the suite is greater than 200 m^2 in area
   c) the suite is greater than 300 m^2 in area
   d) the travel distance to an egress door is 25 m

   ____

2. A mezzanine in a Group F2 occupancy is not required to terminate at a vertical fire separation by Subsection 3.2.8. and is in a sprinklered floor area. The travel distance from any point on the mezzanine to the top of the stair providing egress from the mezzanine is 25 m. The suite in which the mezzanine is located has two means of egress. How large can the mezzanine be to have a single means of egress?

   a) 150 m²
   b) 200 m²
   c) 300 m²
   d) no area restriction provided the travel distance does not exceed 25 m

   ____

   ____

   ______________________________[_______________]

3. What is the maximum area of a hazardous classroom in a sprinklered secondary school if the room has only a single means of egress?

   a) 100 m²
   b) 150 m²
   c) 200 m²
   d) no area restriction provided the travel distance does not exceed 25 m

   ______________________________[_______________]

4. In a sprinklered office building, a tenant has a suite with an area of 320 m² and has two egress doorways. What is the maximum travel distance from any point in the suite to the nearest egress doorway?

   a) 25 m
   b) 30 m
   c) 40 m

d) 45 m

____________________ [__________]

STOP

10.5 DESIGN CRITERIA FOR DOORS, CORRIDORS, GUARDS, AISLES

DOORS

Door Swing

Article 3.3.1.10. outlines the conditions when a door is required to swing in the direction of egress.

Except for sliding doors or partitions permitted by Article 3.3.1.11., all required egress doors shall swing on a vertical axis [Sentence 3.3.1.10.(1)].

Further explanatory material is included in the Large Buildings - 2006 course.

Door Size and Hardware

Article 3.3.1.12. outlines the design criteria for door hardware, locking and latching mechanisms, and operation of door handles.

Further explanatory material is included in the Large Buildings - 2006 course.

Glazing in Doors and Sidelights

The Code recognizes that there is a potential hazard created by glazing in doors, sidelights and partitions where occupants are not aware of the glazing or can mistake a glazed sidelight or partition as a doorway opening.

Glazing criteria is outlined in Article 3.3.1.18. and Article 9.6.6.2. Laminated or tempered glass is required in certain situations.

Further explanatory material is included in the Large Buildings - 2006 course.

Corridors

The minimum width of every public corridor is 1,100 mm [3.3.1.9.(1)]. Corridors in institutional B2 and B3 occupancies may require wider corridors in accordance with Article 3.3.3.3. unless governed by Clause 3.3.1.9.(2)(c).

Further explanatory material is included in the Large Buildings - 2006 course.

Dead-end Corridors

When a corridor is used as an access to exit, the Code generally requires that from the point where a person enters the corridor, there has to be a choice of direction to at least two separate exits. However, under certain conditions the Code permits an exception to this rule and allows the path of travel or a portion of the path of travel to be in a single direction. The condition is referred to as a dead-end corridor. This is not a defined term.

The Code has different dead-end requirements based on the occupancy served by the dead-end.

Read Sentences 3.3.1.9.(7) to (14) and see the attached Table 10-2 for the various requirements. Note that the Group D, E, F-2 and F-3 occupancies allow the option of a maximum length of dead-end of 9 m or no maximum length if the rooms or suites served have a second and separate egress doorway not leading into a dead-end.

Further explanatory material is included in the Large Buildings - 2006 course.

TABLE 10-2

Conditions for Permitting Dead-End Corridors

Code Reference	Occupancy	Length Restrictions Article 3.3.1.4	Conditions
3.3.1.9.(8)	A	none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.3.3.(1)	B	no requirement	Area served by dead-end portion must have a second, independent means of egress.
3.3.1.9.(9) 3.3.1.9.(10)	C	maximum, 6 m	No limit on number of suites, but corridor cannot have doors opening into service or hazardous rooms.
3.3.1.9.(11)	D	maximum, 9 m	Serves maximum occupant load of 30. Doors require self-closing devices.
		or none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.1.9.(12)	E	maximum, 9 m	Serves maximum occupant load of 30. Doors require self-closing devices.
		or none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.1.9.(14)	F-1	none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.1.9.(13)	F-2 & F-3	maximum, 9 m	Serves maximum occupant load of 30. Doors require self-closing devices.
		or none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.

Guards - General

Article 3.3.1.17. provides the general requirement for guards to prevent accidental falls from one level to another. Guards are generally required where the difference in elevation exceeds 600 mm [3.3.1.17.(1)(c)].

Read definition of guard.

There are four basic criteria that apply to guards:

- There is a minimum height for a guard based on its intended use. The general minimum height of a guard is 1,070 mm above the floor surface [3.3.1.17.(1)]. However, there are exceptions to the general rule for specific applications. In assembly occupancies, the guards in fixed seating areas are permitted to be of lower height to accommodate sight lines.

- There is a restriction on the opening through a guard to prevent a small child from falling through the guard [3.3.1.17.(2)].

- There is a restriction on the guard configuration to prevent a guard from being climbable [3.3.1.17.(5)].

- There is a strength criterion for a guard to ensure that it can withstand the lateral loads imposed on the guard [4.1.5.15.].

Guards in Assembly Occupancies

Article 3.3.2.8. has specific requirements that apply to guards in both indoor and outdoor assembly occupancies with fixed seating.

These requirements differ from the general requirements that apply to guards in other locations. They have been developed specifically to prevent accidental falls while accounting for the need to provide acceptable sight lines with minimal obstructions.

Further explanatory material is included in the Large Buildings - 2006 course.

EXERCISE #10-4

1. A classroom in a secondary school has a total occupant load of 60 persons. The room has a single egress door. The door may swing into the classroom. True or False?

____

______________________ [__________]

2. What is the minimum clear opening width of a doorway serving a meeting room in a non-barrier free accessible school. The room has a single means of egress and can accommodate up to 60 persons.

   a) 366 mm
   b) 600 mm
   c) 800 mm
   d) 850 mm

____

______________________ [__________]

3. A tenant wishes to install an electromagnetic locking device (EMLD) on a door to a computer room in an office building. The room is permitted to have a single egress door and will have an occupant load of 15 persons. The EMLD will be installed in accordance with Sentence 3.4.6.15.(4) and may be unlocked by the activation of a pull station located on the room side of the door. Is this locking device permitted, or does it contravene Sentences 3.3.1.12.(2) and (3)?

____

______________________ [__________]

4. A 10 m long dead-end corridor serves two Group F2 industrial tenants on the ground floor of a six storey sprinklered building. Each tenant space is provided with an exit door that opens directly to the exterior. The corridor is separated from each tenant space by a ¾ h fire separation. What is the maximum travel distance permitted from the tenant egress doors through the corridor to the exterior?

   a) 25 m
   b) 30 m
   c) 45 m
   d) no restriction on maximum travel distance

   ____

   ____

   ____

   __________________________[____________________]

5. What is the minimum height of a guard at the foot of a stepped aisle serving a balcony in a theatre?

   a) 660 mm
   b) 760 mm
   c) 920 mm
   d) 1,070 mm

   ____

   ______________________________[_______________]

STOP

10.6 SPECIAL REQUIREMENTS

Protection on Floor Areas with a Barrier-Free Path of Travel

Article 3.3.1.7. provides requirements to ensure that persons with physical or sensory disabilities are provided with additional measures in fire or other life threatening emergencies to compensate for their inability to evacuate a building through the normal means of exit stairs. These requirements apply to storeys above or below the first storey in buildings that are not sprinklered.

Clause 3.3.1.7.(1)(a) permits an elevator that is designed similar to a firefighters' elevator in high-rise buildings as one acceptable option. This elevator must be accessible via a public corridor or vestibule that is separated from the remainder of the building by a 1 h or ¾ h fire separation required by Clauses 3.2.6.5.(3)(b) or (c).

The elevator shaft must be pressurized if the building is over three storeys in building height and is not sprinklered [3.3.1.7.(1)(a)(iii) and 3.3.1.7.(3)].

Another option is to create at least two zones to act as areas of refuge. The travel distance from any point in one zone to another zone must comply with the travel distance requirements for exits and each zone must contain a barrier-free path of travel to an exit.

The final option available only to residential occupancies is to provide a barrier-free accessible balcony in each dwelling unit. There are minimum dimensions for the balcony and the access to the balcony is restricted to a 13 mm high projection above the walking surface by Clause 3.3.1.7.(7)(b).

STOP

Special Requirements for Major Occupancies

Earlier in this module, specific fire separation requirements for different major occupancies were addressed.

In this portion of the module, other special requirements that are unique to various major occupancies will be briefly noted.

When dealing with a specific major occupancy, one should always check the requirements in Subsections 3.3.2. to 3.3.5. for special rules, as this Subsection is a catch all for Code requirements that do not fit in with the major Code subjects like fire separations, exits, construction, etc.

Assembly Occupancies (3.3.2.)

These occupancies can contain large occupant loads often in fixed seating arrangements for viewing public performances. This Subsection of the Code contains the requirements that apply to the seating arrangements, aisles, corridors, exits, stages, guards, occupant loads, etc. that are unique to these occupancies.

Further explanatory material is included in the Large Buildings - 2006 course.

Care and Detention Occupancies (3.3.3.)

In addition to the fire separation requirements previously mentioned in this module, there are special requirements to compartment floor areas in hospitals and nursing homes to act as areas of refuge in emergencies, as it may not be practical to evacuate occupants that are not ambulatory or are in a fragile physical condition.

There are also special fire separation and smoke control measures for special care and treatment facilities like operating rooms, intensive care rooms and critical care units.

Further explanatory material is included in the Large Buildings – 2006 course.

Residential Occupancies (3.3.4.)

There are special egress requirements for residential occupancies in this Subsection.

Industrial Occupancies (3.3.5.)

This Subsection provides a cross reference to the Fire Code and the National Fire Code of Canada for industrial occupancies that may be governed by these regulations or acts.

Further explanatory material is included in the Large Buildings - 2006 course.

STOP

EXERCISE #10-5

1. In an outdoor sports stadium, what is the maximum travel distance from any seat in the seating area to a vomitory leaving the seating area?

   a) 25 m
   b) 30 m
   c) 45 m
   d) 60 m

   ______________________________[______________]

2. What is the minimum height of a guard in the front of seats in the balcony of a theatre?

   a) 660 mm
   b) 760 mm
   c) 920 mm
   d) 1,070 mm

   ______________________________[______________]

3. What is the maximum length of a dead-end aisle in a classroom with fixed seats if the classroom is not fire separated from adjacent classrooms or the corridor?

   a) 6 m
   b) 9 m
   c) 10 m
   d) 25 m

   ______________________________ [______________]

4. What fire separation is required between a kitchen and a cafeteria in an unsprinklered secondary school with an occupant load for 200 persons?

   a) 0 h
   b) 30 min
   c) 1 h
   d) no separation required

   ______________________________ [______________]

5. What minimum row spacing is required in a theatre that has two aisles with 30 seats between the aisles?

   a) 400 mm
   b) 485.4 mm
   c) 497.6 mm
   d) 583 mm

   ______________________________ [______________]

6. What is the minimum riser height for a step in an aisle of a theatre?

   a) 100 mm
   b) 110 mm
   c) 125 mm
   d) 200 mm

   ______________________________ [______________]

10.7 BARRIER-FREE DESIGN

10.7.1 INTRODUCTION (Section 3.8.)

Barrier-free, as defined in the Building Code, means "that a building and its facilities can be approached, entered, and used by persons with physical or sensory disabilities".

Section 3.8. applies to the majority of new buildings, and to extensions or material alterations to existing buildings, and excludes houses, Group F, Division 1 major occupancies, and those buildings which are not intended to be occupied on a daily or full-time basis. The Code specifies how to make buildings and other facilities barrier-free, accessible and safely usable by persons with physical or sensory disabilities. The Code considers the following disabilities:

- mobility impairment (i.e. crutches, wheelchair)
- reaching and manipulation disabilities
- hearing impairment
- visual impairment

This module will focus on the occupancy requirements and design standards for barrier-free design. The majority of these requirements are found in Section 3.8.

Objectives

Upon completion of this module, you will be able to:

- provide an understanding of the Code intent and application of barrier-free design requirements.

- assist with comprehension of applicable Code requirements through the use of exercises.

- identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.

- Understand where the relevant sections are located in the Code to analyze a building and to what extent barrier-free design is applicable.

Upon completion of this module, you will be able to:

- determine to what extent barrier-free design is applicable to each occupancy and ancillary space;
- understand the design standards applicable to different components that form part of a barrier-free path of travel.

10.7.2 GENERAL OVERVIEW

A barrier-free path or travel from the entrances required to be barrier-free shall be provided throughout the entrance storey and within all normally occupied floor areas served by a passenger type elevator, escalator, inclined moving walks or other platform equipped passenger elevating device [3.8.2.1.(1)].

A barrier-free path of travel is generally an accessible route from the sidewalk or roadway and parking area to a principal building entrance and its ground floor level. Where elevating devices are provided within the building to other storeys, it is intended that a barrier-free path of travel be provided to those accessible floor levels.

STOP

10.7.3 GENERAL REQUIREMENTS

With few exceptions, barrier-free design applies to all buildings.

EXERCISE #10-6

Take 2 minutes to scan Subsection 3.8.1. and answer the following questions. Provide Code references with answers where applicable.

1. Which of the following types of buildings may require barrier-free design?

   a) high hazard industrial occupancies
   b) boarding and rooming houses
   c) buildings occupied on a part-time basis such as pump houses and substations
   d) houses, including townhouses and row houses

   ____

   ____

   __________________________ [____________]

2. What is the total number of pedestrian entrances required to be barrier-free in a building that contains a total of (6) six entrances, where (4) four of the entrances serve mercantile occupancies, and (2) two entrances serve an assembly occupancy which is completely separated from the remainder of the building (i.e. assembly occupancy is not accessible via entrances serving mercantile occupancies)? Why?

   ____

   ____

   ____

   __________________________ [____________]

3. If at a required barrier-free entrance there are six exterior doors, all doors are required to be designed in accordance with Section 3.8. True or false?

____

____

____________________________ [____________]

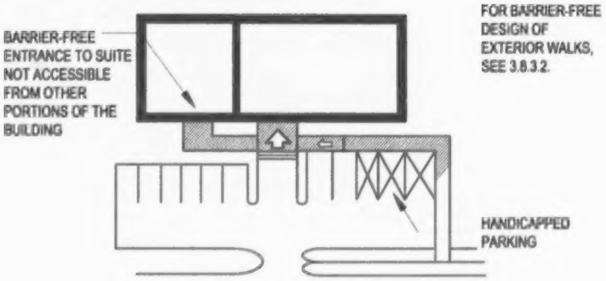
4. The Code requires a barrier-free path of travel to be provided with an unobstructed space not less than 1,600 mm x 1,600 mm at certain intervals to allow persons in wheel chairs to pass one another. What is the maximum interval for these spaces.

a) 25 m
b) 30 m
c) 45 m
d) 60 m

____

____________________________ [____________]

STOP


BARRIER-FREE ENTRANCE TO SUITE NOT ACCESSIBLE FROM OTHER PORTIONS OF THE BUILDING
FOR BARRIER-FREE DESIGN OF EXTERIOR WALKS, SEE 3.8.3.2.
HANDICAPPED PARKING

Suites of assembly occupancy, office or retail used on the first storey or other barrier-free accessible floor levels, and which are not accessible from the remainder of the building, require individual barrier-free entrances.

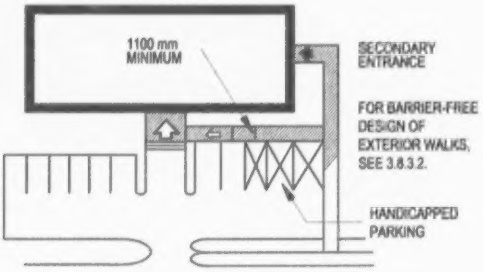

1100 mm MINIMUM
SECONDARY ENTRANCE
FOR BARRIER-FREE DESIGN OF EXTERIOR WALKS, SEE 3.8.3.2.
HANDICAPPED PARKING

FIGURE 10-4

10.7.4 OCCUPANCY REQUIREMENTS

Generally a barrier-free path of travel is required throughout the entrance storey, and within every floor area served by an elevator or other passenger elevating devices in all buildings, except to those occupancies which are exempt from accessibility requirements.

EXERCISE #10-7

Read Subsection 3.8.2. and answer the following questions.

1. Other than as required by Sentence 3.8.2.1.(4), the provision of a barrier-free path of travel for residential occupancies applies to which of the following:

   a) into suites that are located in storeys above the entrance storey and not served by an elevator
   b) into suites served by an elevator
   c) within all portions of suites served by an elevator
   d) egress from suites served by an elevator

   ____

   ____

   ____

   ____________________ [__________]

2. When is a balcony in a dwelling suite required to be barrier-free accessible? (Hint: Review requirements of Article 3.3.1.7.)

   ____

   ____

   ____________________ [__________]

3. Consider a shopping mall with a public corridor and a food court area with washrooms located within 45 m of the food court area. What are two possible options to meet the barrier-free washroom requirements?

____

____________________________ [__________]

____

____________________________ [__________]

4. Consider a strip mall with individual mercantile suites. Which mercantile suites do not require a barrier-free washroom?

____

____________________________ [__________]

____

____________________________ [__________]

STOP

10.7.5 DESIGN STANDARDS

Specific criteria is prescribed by the Code for the design of facilities provided in a barrier-free path of travel to serve persons requiring assistance. Major design components of Subsection 3.8.3. are identified for discussion purposes.

Doorways and Doors

All doorways in a barrier-free path of travel are required to provide a clear width of 850 mm [3.8.3.3.(1)]. Standard wheelchairs range from 584 mm to 685 mm in width.

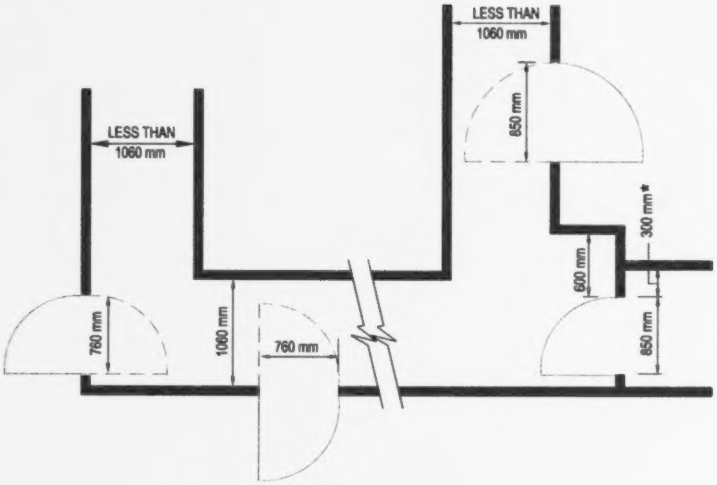
Clear width is defined as the width of the doorway measured with the door in the open position. As such, the minimum width of a door in a barrier-free path of travel should be approximately 915 mm to ensure the minimum clear width of 850 mm (note that door widths may have to be increased to allow for any projecting exit hardware).

Sufficient clearance on the latch side of the door is required to permit a person in a wheelchair to approach and open a door, unless the door is equipped with a power door operator. Where a door swings away from the approach side, a 300 mm clearance to the latch side of the door is required. Where a door swings toward the approach side, a 600 mm clearance to the latch side of the door is required [3.8.3.3.(10)]. This requirement does not apply within residential suites except as described in Clause 3.8.2.1.(4).

See Figure 10-5.

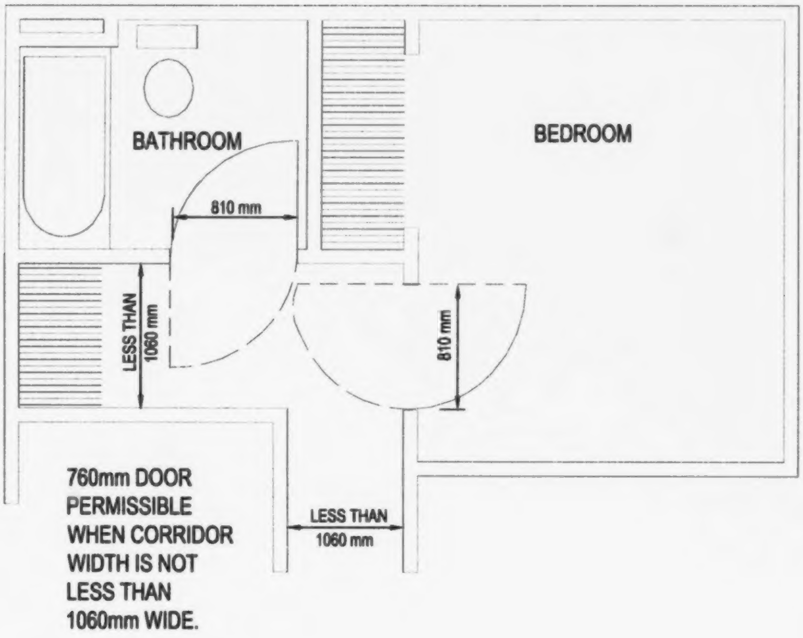
Where residential suites are located on a barrier-free storey, doorways serving bedrooms and washrooms are regulated [3.8.3.3.(2)]. The remainder of the suite is not regulated except for 10% of residential suites [3.8.2.1.(4)]. Hotel suites are different. Review Article 3.8.2.4.

See Figure 10-6.


LESS THAN
1060 mm
LESS THAN
1060 mm
850 mm
300 mm*
600 mm
760 mm
1060 mm
760 mm
850 mm

* Note: Does not apply to residential suites not regulated by Sentence 3.8.2.1(4)

FIGURE 10-5


BATHROOM
BEDROOM
810 mm
LESS THAN 1060 mm
810 mm
LESS THAN 1060 mm

760mm DOOR PERMISSIBLE WHEN CORRIDOR WIDTH IS NOT LESS THAN 1060mm WIDE.

FIGURE 10-6

Power door operators are required for entrances serving hotels and care and treatment occupancies. Any entrance that serves a building > 300 m^2 having a A, D or E occupancy requires power door operation. However, if individual suites in buildings having only assembly/business and personal services/retail occupancies are completely cut off from the remainder of the building, and are less than 300 m^2 in area, a power door operator is not required [3.8.3.3.(5) to (7)].

Vestibules in a barrier-free path of travel are required to provide a sufficient length between two doors in series. The minimum length between doors is 1,200 mm plus the width of the door that swings into the vestibule [3.8.3.3.(11)].

Ramps (3.8.3.4.)

Ramps in a barrier-free path of travel are not permitted to exceed a 1 in 12 slope. Ramps are permitted to extend a maximum of 9 m horizontally between level areas [3.8.3.4.(1)(b) and (d)(i)].

Level areas that divide ramps into intervals of not more than 9 m, are required to be at least 1,670 mm long and at least the same width as the ramp [3.8.3.4.(1)(d)]. The top and bottom of ramps are required to have level areas that are at least 1,670 mm long and 1,670 mm wide [3.8.3.4.(1)(c)]. Ramps are required to have a minimum width of 900 mm between handrails [3.8.3.4.(1)(a)].

See Figure 10-7.

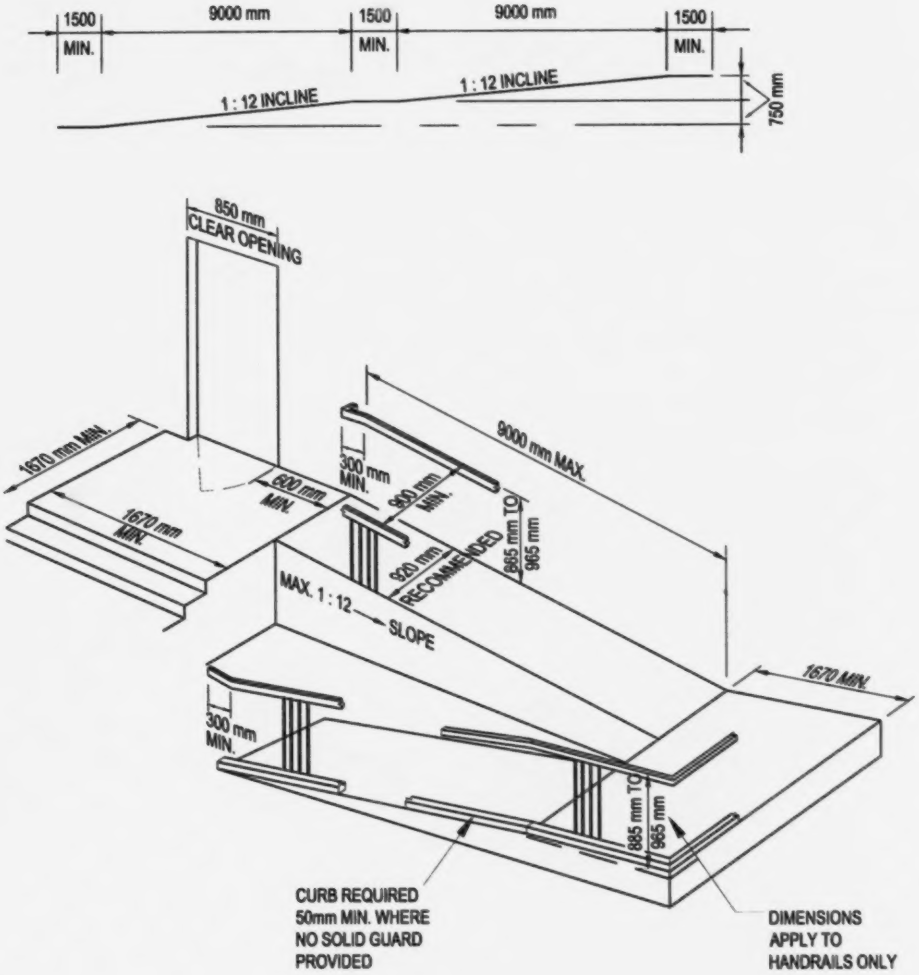

1500
MIN.
9000 mm
1500
MIN.
9000 mm
1500
MIN.
1 : 12 INCLINE
1 : 12 INCLINE
750 mm
850 mm
CLEAR OPENING
1670 mm MIN.
1670 mm MIN.
600 mm MIN.
300 mm MIN.
900 mm MIN.
9000 mm MAX.
920 mm RECOMMENDED
865 mm TO 965 mm
MAX. 1 : 12 SLOPE
1670 MIN.
300 mm MIN.
865 mm TO 965 mm
CURB REQUIRED
50mm MIN. WHERE
NO SOLID GUARD
PROVIDED
DIMENSIONS
APPLY TO
HANDRAILS ONLY

FIGURE 10-7

Seating Areas (3.8.3.6.)

Assembly areas with fixed seating are required to provide designated seating for wheelchair use [3.8.2.1.(3)]. The floor slope required for a barrier-free path of travel is only intended to apply to the actual designated seating and aisles leading to the seating area. It is not intended to apply to aisles and floor areas serving fixed seating [3.8.3.6.(1)].

Assistive Listening Devices (3.8.3.7.)

Certain rooms in buildings of Assembly occupancy are required to be equipped with assistive listening systems, if they are greater than 100 m^2 in area and have an occupant load of more than 75 people [3.8.3.7.(1)].

Washrooms (3.8.3.8., 3.8.3.9., 3.8.3.11., 3.8.3.12.)

Where barrier-free washrooms are required, at least one water closet stall is required to meet the dimensional requirements outlined in Articles 3.8.3.8. and 3.8.3.9., and lavatories are required to meet the requirements of Article 3.8.3.11.

Universal unisex washrooms may be provided as an alternative to providing barrier-free washroom stalls in individual washrooms used by the general public. The dimensional requirements are outlined in Article 3.8.3.12.

Showers (3.8.3.13.)

Buildings provided with groups of shower stalls are required to be provided with at least one barrier-free shower stall conforming to the dimensional requirements outlined in Article 3.8.3.13. This does not apply within a suite of residential occupancy.

Individual shower stalls provided for patients or residents in a care/treatment occupancy must be barrier-free.

Public Telephones (3.8.3.15.)

Public telephones provided with built-in shelves or counters are required to meet the dimensional requirements outlined in Article 3.8.3.15.

Drinking Fountains (3.8.3.16.)

Drinking fountains are required to meet the dimensional requirements outlined in Article 3.8.3.16.

STOP

EXERCISE #10-8

Take 20 minutes to answer the following questions located in Subsection 3.8.3.

1. What is the minimum clear width of a door serving a bathroom in a barrier-free path of travel in a residential occupancy if the corridor serving the bathroom is 1,070 mm wide?

   a) 760 mm
   b) 790 mm
   c) 810 mm
   d) 900 mm

   ____

   ______________________________ [____________]

2. What is the latch side clearance of a bathroom door located in a residential suite not regulated by Sentence 3.8.2.1.(4) that swings towards the approach side? Explain.

   ____

   ______________________________ [____________]

3. What is the minimum clearance within a barrier-free water closet stall that will permit the stall door to swing into the stall?

____

______________________________ [__________]

4. What is the minimum dimension of a universal barrier-free washroom?

   a) 1,100 mm
   b) 1,200 mm
   c) 1,500 mm
   d) 1,700 mm

____

______________________________ [__________]

5. If a Group B occupancy contains individual shower stalls, what is the required mounting height above the floor of a folding seat that is not spring loaded and is located in a barrier-free shower?

   a) 400 mm
   b) 430 mm
   c) 450 mm
   d) 460 mm

______________________________ [__________]

STOP

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Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 11

COMPLEX BUILDINGS - 2006

FIRE ALARM, LIGHTING AND EMERGENCY POWER SYSTEMS

11.1 INTRODUCTION

This module refers to active fire protection and life safety building systems, provisions for fire department access to a building, and interconnected floor spaces other than atriums.

This module will concentrate on requirements in the Building Code for:

- fire alarm and detection systems
- lighting and emergency power systems
- in the Large Buildings - 2006 course, fire department building access, sprinkler systems, mezzanines, interconnected floor spaces (other than atriums) and standpipe systems are reviewed.

This module addresses Part 3 requirements, that are applicable to new buildings, new additions, and where required by Parts 10 and 11, regarding change of use and major renovations.

This module includes a list of defined terms relating to the content in this module. For a complete list of definitions, refer to Division A, Part 1 of the Code.

Objectives

Upon completion of this module, you will be able to:

- familiarize Code users as to where to find requirements for the above listed systems,
- understand the steps and the process of applying Code requirements,
- demonstrate the procedure/method of applying Code requirements to obtaining your answer.

Upon completion of this module, you will be able to:

- determine fire alarm requirements for a building.
- identify lighting and emergency power requirements.

11.2 DEFINITIONS

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Defined terms are found throughout the Code and are identified in italics text. While defined terms are shown in italics in this section, they will not be shown in italics where used elsewhere in this module.

It is important to recognize that a defined term is an integral part of the requirement in which it is found. The defined term must be understood and applied within the context of the requirement.

Alarm signal
Alarm signal means an audible signal transmitted throughout one or more zones of a building or throughout a building to advise occupants that a fire emergency exists.

Alert signal
Alert signal means an audible signal to advise designated persons of a fire emergency.

Building height
Building height means the number of storeys contained between the roof and the floor of the first storey.

Fire compartment
Fire compartment means an enclosed space in a building

a) that is separated from all other parts of the building by enclosing construction that provides a fire separation, and
b) that may be required to have a fire-resistance rating.

Fire detector
Fire detector means a device that detects a fire condition and automatically initiates an electrical signal to actuate an alert signal or alarm signal and includes heat detectors and smoke detectors.

Heat detector
Heat detector means a fire detector designed to operate at a predetermined temperature or rate of temperature rise.

Service space
Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Smoke alarm
Smoke alarm means a combined smoke detector and audible alarm device designed to sound an alarm within the room or suite in which it is located on the detection of smoke within that room or suite.

Smoke detector
Smoke detector means a fire detector designed to operate when the concentration of airborne combustion products exceeds a pre-determined level.

Sprinklered
Sprinklered means equipped with a system of automatic sprinklers.

Storage garage
Storage garage means a building or part of a building that is intended for the storage or parking of motor vehicles and that contains no provision for the repair or servicing of motor vehicles.

Storey
Storey means, except for the purposes of Part 7 of Division B, the portion of a building,

a) that is situated between the top of any floor and the top of the floor next above it, or
b) that is situated between the top of the floor and the ceiling above the floor, if there is no floor above it.

STOP

11.3 FIRE ALARM AND DETECTION SYSTEMS (Subsection 3.2.4.)

General Overview

Subsection 3.2.4. addresses fire alarm system requirements.

In its simplest form, the purpose of a fire alarm system is to alert building occupants of a potential fire condition. A fire alarm system can be activated manually by a person operating a manual pull station. The fire alarm system can also be activated automatically by fire detectors and water flow switches in sprinkler systems.

Occupants of a building are alerted to an alarm activation from audible, and in some mandated cases, from visual devices. In certain conditions, the Code mandates automatic notification of the fire department, either directly or through a proprietary monitoring station.

A fire alarm system may also perform other functions:

- supervision of auxiliary devices, sprinkler and standpipe shut off valves, fire alarm circuits, fire pump power supply, etc.
- release magnetic hold-open devices and electromagnetic locks.
- provide visual indication of location of alarm activation by the fire alarm annunciator.

Fire Alarm System Requirements

The first step is to determine if a building is required to be provided with a fire alarm system. This determination is provided in Sentence 3.2.4.1.(2).

Prior to familiarizing yourself with Sentence (2), an important distinction must be made with respect to Clause 3.2.4.1.(2)(c). The Clause refers to ". . . more than 3 storeys, including storeys below the first storey". Many requirements in the Code that are dependent on building height refer to "building height". Building height is a defined term and refers to the number of storeys between the first storey and the roof, and does not include storeys below the first storey. The determination of the number of storeys, for the purpose of applying Clause (c), includes storeys below the first storey, as well as the storeys above the first storey.

STOP

Procedure to Determine Whether a Building is Required to be Provided with a Fire Alarm System

Carefully read the requirements in Sentence 3.2.4.1.(2). In order to clarify the intent of Sentence 3.2.4.1.(2), Sentence 3.2.4.2.(3) should also be reviewed.

1. All buildings that exceed 3 storeys (including storeys below the first storey) are required to be provided with a fire alarm system [Clause 3.2.4.1.(2)(c)].

2. For buildings of 3 storeys or less (including storeys below grade):

   a) determine whether the building complies with either Sentence 3.2.4.1.(3) for some dwellings, (4) for some hotels not exceeding 3 storeys, or (5) for some open-air garages, or 3.2.4.2.(4) for a building not exceeding 3 storeys with a continuous 1 h fire separation. If the above do not apply, proceed to 2(b) and 2(c).

   b) determine occupancy classification (refer to Subsection 3.1.2.), then

   c) review the Clauses under Sentence 3.2.4.1.(2) individually for applicability to establish the occupant load (refer to Subsection 3.1.17.).

EXERCISE #11-1

Refer to Articles 3.2.4.1. and 3.2.4.2., and using the above procedure, answer the following questions.

(Circle the correct answer and cite Code reference)

1. Is a fire alarm system required for a two storey building where both storeys are classified as Group F, Division 2 industrial occupancy, and the occupant load of each storey is 60 persons?

   a) Yes
   b) No

   ____

   ____

   ____

   ____________________ [__________]

2. Refer to Figure 11-1. A two storey addition is proposed to be constructed to the one storey existing building located at the northwest corner of North Shore Avenue and Sunset Beach Road.

   The addition will be separated from the existing building by a fire separation with a minimum 1 h fire-resistance rating.

   The existing one storey building is a restaurant with an occupant load of 143 persons. The two storeys of the addition will be used for offices. The calculated occupant load of the ground floor addition is 85 persons and the second floor is 90 persons.

   Only building service pipes and electrical wiring in noncombustible raceways penetrate the 1 h fire separation. There are no communicating openings in the 1 h fire separation. Which statement below is correct?

a) The entire building is required to be provided with a fire alarm system.

b) Only one suite is required to be equipped with a fire alarm system.

c) No fire alarm system is required.

STOP

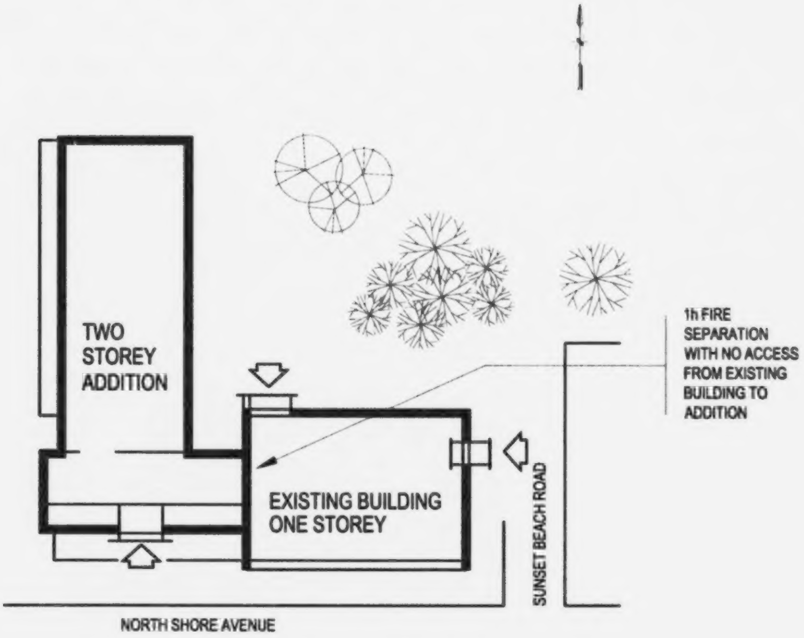
TWO STOREY ADDITION
EXISTING BUILDING ONE STOREY
1h FIRE SEPARATION WITH NO ACCESS FROM EXISTING BUILDING TO ADDITION
SUNSET BEACH ROAD
NORTH SHORE AVENUE

FIGURE 11-1

Article 3.2.4.5. "Installation and Verification of Fire Alarm Systems" references the appropriate ULC standard for the installation of a fire alarm system, including those with voice communication capabilities [CAN/ULC-S524-M], and for testing and verifying the fire alarm system [CAN/ULC-S537-M].

Types of Fire Alarm Systems

There are two types of fire alarm systems addressed in the Code: single stage and two-stage.

Article 3.2.4.3. "Types of Fire Alarm Systems" identifies the type of fire alarm required based on occupancy classification. Clauses 3.2.4.3.(1)(a) to (d) identify the type of system that is required for specific occupancies. All other occupancies are permitted to be provided with either single stage or two-stage systems.

Article 3.2.4.4. "Description of Fire Alarm Systems" provides the approach (when and how) for causing the alarm signal to activate.

- Single stage - activation of a pull station or fire detector will cause an alarm signal (evacuation signal) to sound on all audible devices.

- Two-stage - activation of a pull station or fire detector will cause an alert signal. Manual alarm signal activation is required and initiated by the use of a key or similar device in the manual pull station. Except for a Group B, Division 2 occupancy, the alarm signal must activate automatically if the alert signal is not acknowledged within 5 min. In a building containing a hotel, activation of the alert signal must cause immediate activation of the alarm signal in the initiating fire zone and an alert signal to sound throughout the hotel to notify hotel staff.

Audible and Visual Signals

Article 3.2.4.6. "Silencing of Alarm Signals" provides criteria for silencing the audible devices of a fire alarm system.

Article 3.2.4.18. "Alert and Alarm Signals" provides rules for using audible signal devices for paging and for similar voice messages when the signals are used to sound both alert and alarm signals.

(Refer to Clause 3.2.4.22.(3)(a) for rules as to when alert and alarm signals are permitted to be silenced for the transmission of voice messages.)

Sentences 3.2.4.18.(4), (5) and (6) provide requirements for visual signal devices.

Article 3.2.4.19. "Audibility of Fire Alarm Systems" provides requirements regarding clarity of audible signals throughout a floor area, and minimum required quantitative sound pressure levels, taking into consideration ambient noise levels.

Sentence 3.2.4.19.(2) specifies ISO 8201as the standard for the temporal pattern of an alarm signal. Sentence 3.2.4.21.(9) requires that the sound patterns of smoke alarms be significantly different from the temporal patterns of alarm signals. Sentence 3.2.4.19.(7) provides requirements for visual signal devises where ambient noise levels exceed 87 dBA, or where the use of ear protection devices are required. Visual signal devices are also required where occupants may be located inside an audiometric booth or sound insulated enclosure.

Sentences 3.2.4.19.(9) and (14) provide requirements for the silencing of alarm audible devices inside dwelling units or suites of residential occupancies.

Article 3.2.4.20. references the requirements for visual signal devices, as well as requirements found elsewhere in this Subsection for fire alarms. Therefore, to review all requirements pertaining to visual signal alarm devices, refer to this Article first.

Sentence (1) requires that visual signal devices be visible throughout the floor area, or part of the floor area, where visual signal devices are required in Sentences 3.2.4.18.(4), 3.2.4.19.(7) and (8), and where they are permitted by Sentence 3.2.4.18.(5).

Fire Department Notification

Article 3.2.4.7. "Signals to Fire Department", identifies conditions where specific signals from the fire alarm system are required to be transmitted to the fire department directly or to a proprietary monitoring station.

The following conditions require the transmission of fire alarm signals to the fire department:

a) Group A (assembly) occupancy with an occupant load exceeding 300 persons,

b) All Group B (detention, care, and care and treatment) occupancies,

c) Group F, Division 1 (high hazard) occupancy,

d) Buildings regulated under Subsection 3.2.6. (high buildings), OR

e) Buildings that contain interconnected floor spaces that are required to comply with Articles 3.2.8.3. to 3.2.8.11 (atriums).

Where a single stage alarm is installed in an unsprinklered building, a legible notice shall be affixed to the wall near each pull station stating:

a) fire department is to be notified

b) emergency telephone numbers for either the municipality or the fire department [3.2.4.7.(5)].

It should also be noted that the requirement for automatic fire alarm transmission to the fire department may also originate from Article 3.2.2.17. where a sprinkler system is provided in lieu of a roof fire rating.

STOP

EXERCISE #11-2

(Circle the correct answer and cite Code reference)

1. Where a fire alarm system is required, visual alarm signal devices must be provided:

   a) in a compartment referred to in Article 3.3.3.6.

   b) where ambient noise levels exceed 75 dBA

   c) in an assembly occupancy in which music and other sounds associated with a performance may exceed 100 dBA.

   d) in a normally occupied space where the required sound pressure level of the fire alarm audible devices are 10 dBA below the required level.

____

____

____

_________________________[__________]

STOP

Annunciators

Article 3.2.4.8. "Annunciator and Zone Indications" provides criteria for determining whether an annunciator panel is required, and lists the parameters for separate zones on a fire alarm system.

Annunciators are required to be located ". . . in close proximity to a building entrance that faces a street or an access route" [3.2.4.8.(1)].

Annunciators are not required in the following circumstances:

- In a building that has an aggregate floor area for all storeys, not exceeding 2,000 m^2 and does not exceed 3 storeys in building height [3.2.4.8.(5)].
- In a building where a fire alarm control unit (complete with all trouble alarm signals) is installed at the building entrance that has a fire access route [3.2.4.8.(7)].
- If only one zone is required by Sentence 3.2.4.8.(2) [3.2.4.8.(3)].

If an annunciator is not required and is not installed, a visual and audible trouble signal device is required to be provided inside the building main entrance [3.2.4.8.(4)].

Article 3.2.4.16. "System Monitoring" provides additional annunciation requirements for sprinkler systems.

Electrical Supervision

Article 3.2.4.9. "Electrical Supervision" requires that electrical supervision be provided for all fire alarm systems [3.2.4.9.(1)]. If a fire alarm system is installed in a building, a sprinkler system in that building is required to be electrically supervised in compliance with Sentence 3.2.4.9.(2).

In addition, Article 3.2.2.17. "Sprinklers in Lieu of Roof Rating" requires that a sprinkler system, that is provided in lieu of roof fire rating, be electrically supervised regardless of whether the building is required to be provided with a fire alarm system.

STOP

EXERCISE #11-3

(Circle the correct answer and cite Code reference)

1. Under what conditions are annunciator panels not required for fire alarm systems?

   a) A building not more than 3 storeys in building height that does not exceed an aggregate floor area of 2,000 m^2 for all storeys.

   b) A building not more than 3 storeys in building height that does not exceed 20,000 m^2 in building area

   c) Where not more than two zones are required.

   ____________________ [____________]

STOP

Fire Detectors

Article 3.2.4.10. "Fire Detectors" lists areas where fire detectors are required. Where a fire detector is required, a heat or smoke detector may be used (refer to fire detector definition).

Article 3.2.4.11. "Smoke and Heat Detectors", however, identifies where smoke detectors must be installed and where heat detectors must be provided. Specific areas of specific occupancies require the installation of smoke detectors or heat detectors. In these conditions, a heat detector is not permitted to be used where a smoke detector is required and vice versa.

Duct smoke detection is required by Sentence 3.2.4.12.(1) "Prevention of Smoke Circulation" in an air handling system that serves more than one storey, one suite, one patient/ resident sleeping area fire zone [3.3.3.5.(2)], or is not provided with fire dampers as permitted in Sentence 3.1.8.8.(8).

Article 3.2.4.14. "Elevator Emergency Return" provides requirements for smoke detection for elevator recall lobbies. Only elevators that serve floors above the first storey in an unsprinklered high building are required to be provided with automatic emergency recall [3.2.4.14.(1)].

Article 3.2.4.15. "Sprinklers in Lieu of Fire Detectors" waives fire detector requirements in Article 3.2.4.10. and heat detector requirements in Sentence 3.2.4.11.(2) in sprinklered floor areas, provided that the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(2). However, the smoke detector requirements in Sentence 3.2.4.11.(1) are not waived.

Smoke Alarms (3.2.4.21.)

Smoke alarm is a defined term and is not the same as a smoke detector. A smoke alarm is not connected to a fire alarm system. It is a detection device as well as an audible alarm device. A smoke alarm may be a stand-alone unit or interconnected with other smoke alarms within the same dwelling unit.

Article 3.2.4.21. "Smoke Alarms" applies exclusively to dwelling units, and except for care and detention occupancies that are required to be provided with a fire alarm system, sleeping rooms that are not located within a dwelling unit. Smoke alarms are not required for sleeping rooms in care or detention occupancies that are required to be equipped with a fire alarm system.

Sprinkler Monitoring (3.2.4.16.)

Article 3.2.4.16. "System Monitoring" requires sprinkler systems to be provided with water flow detecting devices, and dictates how those devices are to be annunciated on the fire alarm system. Water flow devices are required to be connected to activate an alarm signal in a single stage fire alarm system and may initiate an alert signal or an alarm signal on a two-stage system.

Pull Stations (3.2.4.17.)

Article 3.2.4.17. "Manual Pull Stations" identifies where manual pull stations are required to be located.

- Sentence (1) is the primary requirement for pull stations (i.e. pull stations are required near the principal entrance and near every required exit).

- Sentences (2) through (7) apply to hotels or dwelling units.

- Sentence (8) applies to impeded egress zones and contained use areas in Group B, Division 1 and 2 occupancies.

Due to barrier-free requirements in Article 3.8.1.5., fire alarm pull stations are required to be located not more than 1200 mm above the finished floor.

Pull stations are required to be provided by Clause 3.4.6.15.(4)(f) for the installation of electromagnetic locks.

Voice Communication (3.2.4.22.)

Article 3.2.4.22. "Voice Communication Systems" applies primarily to high buildings, with one exception:

- A voice communication system is required for an assembly occupancy with fixed seats, if the aisles are designed to comply with Sentence 3.3.2.4.(14). Clause 3.3.2.4.(14)(f) requires a voice communication system that complies with Article 3.2.4.22.

Clause 3.2.4.22.(1)(a) requires that a two-way communication system for each floor area be provided with connections to the central alarm and control facility (CACF) and to the mechanical control centre.

The requirements in Article 3.2.4.22 are summarized as:

- Sentence (2) – Silencing the alarm signal in a single stage system to allow transmission of voice messages is permitted after 30 s.

- Sentence (3) – Silencing the alert and alarm signals in a two-stage system to allow transmission of voice messages is permitted after the alert signal has transmitted for not less than 10 s in hospitals with 24 h supervision, or 30 s for all other occupancies.

- Sentence (4) – Loudspeaker system required in Clause 3.2.4.22.(1)(b) be designed for selectivity to any zone or zones.

- Sentence (5) – The emergency telephones for the two-way communication system required in Clause 3.2.4.22.(1)(a) are required to be located in each floor area near each exit stair shaft.

For high buildings subject to the requirements of Subsection 3.2.6. "Additional Requirements for High Buildings", the Voice Communication System is required to comply with Article 3.2.4.22., subject to the conditions of Sentence 3.2.6.8.(1).

STOP

EXERCISE #11-4

(Circle the correct answer and cite Code reference)

1. Where is a smoke detector required to be used:

   a) in a janitor's room

   b) in every room in buildings classified as Group A, Division 1

   c) in every corridor in parts of a building classified as Group A, Division 1 major occupancy.

   ______________________________ [______________]

2. Sprinklers are permitted by Subsection 3.2.4. in lieu of fire detectors provided:

   a) The sprinkler system is electrically supervised.

   b) The sprinkler system is a wet system.

   c) The building is not subject to the requirements of Subsection 3.2.6.

   d) The sprinkler system is monitored.

   ______________________________ [______________]

STOP

11.4 LIGHTING AND EMERGENCY POWER SYSTEMS (Subsection 3.2.7.)

This Subsection provides minimum requirements for normal illumination levels and emergency lighting illumination levels, emergency power for lighting, fire alarm system, and building services. Minimum illumination levels for normal and emergency lighting are quantified in Lux (lx) and in foot-candles (ft-candles).

Article 3.2.7.1. "Minimum Lighting Requirements" requires adequate illumination levels under normal power conditions to occupied areas to ensure safety of operation and for egress.

Article 3.2.7.2. "Recessed Lighting Fixtures" does not permit the installation of recessed lighting fixtures in an insulated ceiling, unless the lighting fixture is designed for that purpose. Lighting fixtures that are not designed for installation in insulated ceiling spaces may create a fire hazard.

Article 3.2.7.3. "Emergency Lighting" lists all areas that are required to be provided with emergency lighting and the minimum required illumination levels.

The following areas are required to be provided with emergency lighting with an average illumination level of not less than 10 lx at floor or tread level:

- Exits,
- principal routes providing access to exit in open floor areas and service rooms,
- corridors used by the public,
- corridors serving patients' or residents' sleeping rooms in a Group B, Division 2 or Division 3 occupancy,
- corridors serving classrooms,
- underground walkways,
- public corridors,

- floor areas or parts where the public may congregate in
  - Group A, Division 1 occupancies, or
  - Group A, Division 2 or 3 occupancies having an occupant load of 60 persons or more,
- floor areas or parts in daycare centres where persons are cared for,
- food preparation areas in commercial kitchens,
- aisles, internal corridors, and principal routes providing access to exit in a floor area that is not subdivided into rooms, or that is subdivided into rooms, in Group D, E and F occupancies (i.e. main passageways that lead to exits) [3.2.7.3.(1)].

Emergency lighting is also required at doorways that are equipped with electromagnetic locking devices [Clause 3.4.6.15.(4)(k)].

Article 3.2.7.4. "Emergency Power for Lighting" requires the following minimum duration of emergency power for the emergency lighting required by the previous Article:

- 2 h for high buildings (within the scope of Subsection 3.2.6.),
- 1 h for Group B major occupancies that are not within the scope of Subsection 3.2.6., and
- 30 min for other buildings.

Article 3.2.7.5. "Emergency Power Supply Installation" refers to the CSA-C282, "Emergency Electrical Power Supply for Buildings" standard for emergency power supply installation for buildings other than hospitals.

Emergency power and lighting for health care facilities shall conform to CSA-Z32 "Electrical Safety and Essential Electrical Systems in Health Care Facilities".

The required edition of the above CSA standards is provided in Division B, Part 1, Table 1.3.1.2.

Fuel Supply Shut-off Valves and Exhaust Pipes

Article 3.2.7.7. "Fuel Supply Shut-off Valves and Exhaust Pipes" requires an outdoor shut-off valve for an outdoor source of liquid or gas fuel supply to an engine that drives an emergency electric power system.

Sentence (2) requires that exhaust pipes from an engine of an emergency power system be located in a service shaft that has a fire rating at least equal to the fire separation penetrated but in no case less than 45 min.

Emergency Power for Fire Alarm Systems

Article 3.2.7.8. "Emergency Power for Fire Alarm Systems" addresses emergency power requirements for the fire alarm system, and for a voice communication system that is required by Article 3.2.6.8. "Voice Communication System".

Sentences 3.2.7.8.(1) through (4) address the fire alarm system.

Sentence 3.2.7.8.(2) requires an emergency power supply for the fire alarm system to be provided by battery, generator or a combination of both. In the event of a power failure, Sentence 3.2.7.8.(4) requires the transfer from normal electrical power to emergency power to be automatic.

Sentence 3.2.7.8.(3) requires the emergency power source for the fire alarm system to be capable of providing supervisory power for a minimum duration of 24 h, **plus**

- 2 h under full load for a fire alarm system for buildings within the scope of Subsection 3.2.6. (high buildings), or
- 1 h under full load for a Group B building that is not within the scope of Subsection 3.2.6.,
- 5 min under full load for a building that is not required to be equipped with an annunciator [refer to Subclause 3.2.4.8.(3)(b)(iii), and
- 30 min under full load for all other buildings.

Emergency Power for Building Services

Article 3.2.7.9. "Emergency Power for Building Services" addresses emergency power provisions for specific building services that include:

- elevators,
- water supply for fire fighting, and
- fans and electrical equipment used for smoke control.

Emergency power for elevators is required by Clause 3.2.7.9.(1) to be provided by generator for:

- every firefighters' elevator (there may be more than one), and
- every elevator car serving storeys more than 36 m high measured between grade and the floor level of the top storey,
- fans and equipment required by Article 3.2.6.2., and
- fans for venting by Article 3.2.6.6.,
- Sentence 3.2.7.9.(2) requires that the emergency power required for elevators in Clause 3.2.7.9.(1)(a) be capable of operating all required firefighters' elevators and one additional elevator simultaneously.

  A building is exempt from Sentence 3.2.7.9.(2) if each elevator subject to Clause 3.2.7.9.(1)(a) can be recalled from the most remote storey to the firefighter building entrance level, or to a transfer lobby, within 5 min.

Protection of Electrical Conductors (3.2.7.10.)

Electrical conductors that are used in conjunction with fire alarm systems and with emergency equipment described in Articles 3.2.6.2. to 3.2.6.8., 3.2.7.3., and Sentences 3.3.3.6.(1) and 3.3.3.7.(4) shall be protected as per Sentences 3.2.7.10.(2) to (8).

Emergency Power for Water Supply for Firefighting

Clause 3.2.7.9.(1)(b) and Sentences 3.2.7.9.(4) and (5) address emergency power requirements for water supply for firefighting purposes.

With respect to Clause 3.2.7.9.(1)(b) for high buildings, water supply refers to the water supply that is required for the sprinkler or standpipe system and that is dependent on electrical power supplied to the building (i.e. if a fire pump is required to provide the required water flow (volume and/or pressure)) for the sprinkler or standpipe system.

Emergency power by emergency generator is required for a water supply that is dependent on electrical power supplied to the building, for a duration of not less than:

- 2 h under a full load for a building within the scope of Subsection 3.2.6 (high buildings) [Clause 3.2.7.9.(1)(b)].
- 30 min under a full load for buildings not within the scope of Subsection 3.2.6. This requirement does not apply to a standpipe system [Sentences 3.2.7.9.(4) & (5)]. It applies to sprinkler systems.

Emergency Power for Electrical Equipment for Smoke Control

Clause 3.2.7.9.(1)(c) requires that emergency power by generator be provided to fans and electrical equipment for smoke control systems required by Article 3.2.6.2.

EXERCISE #11-5

(Circle the correct answer and cite the Code reference)

1. Based on Subsection 3.2.7., what is the minimum required duration for emergency power for lighting in a hospital that is not within the scope of Subsection 3.2.6.?

   a) 1 h
   b) 2 h
   c) 30 min

   ____

   ____

   ______________________________ [______________]

2. Which statement below is correct regarding emergency power to provide adequate water supply for firefighting for buildings not regulated under Subsection 3.2.6.?

   a) Emergency power is not required to provide adequate water supply to a standpipe system.
   b) Emergency power is required to provide adequate water supply to a standpipe system.
   c) Emergency power is required to provide adequate water supply to a sprinkler system.

   ____

   ____

   ______________________________ [______________]

STOP

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Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 12

COMPLEX BUILDINGS - 2006

INTERCONNECTED FLOOR SPACES

PART 1

12.1 INTRODUCTION

This module covers the requirements for mezzanines and interconnected floor spaces other than atriums.

This module includes a list of defined terms relating to the content in this module. For a complete list of definitions, refer to Part 1, Division A.

Objectives

Upon completion of this module, you will be able to:

- familiarize Code users where to find requirements for mezzanines and interconnected floor spaces,
- understand the steps and the process of applying the Code requirements,
- demonstrate the procedure/method of applying the Code requirements to obtain your answer.

Upon completion of this module, you will be able to:

- Determine the types of mezzanines and interconnected floor conditions, and which requirement applies to them.

12.2 DEFINITIONS

Definitions

The definitions below relate to the content in this module and are from Part 1, Division A. Defined terms are found throughout the Code and are identified in italics text. While defined terms are shown in italics in this section, they will not be shown in italics where used elsewhere in this module.

It is important to recognize that a defined term is an integral part of the requirement in which it is found. The defined term must be understood and applied within the context of the requirement.

Building height
Building height means the number of storeys contained between the roof and the floor of the first storey.

Interconnected floor space
Interconnected floor space means superimposed floor areas or parts of floor areas in which floor assemblies that are required to be fire separations are penetrated by openings that are not provided with closures.

Mezzanine
Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or storey and includes an interior balcony.

Service space
Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Sprinklered
Sprinklered means equipped with a system of automatic sprinklers.

Storage garage

Storage garage means a building or part of a building that is intended for the storage or parking of motor vehicles and that contains no provision for the repair or servicing of motor vehicles.

Storey

Storey means, except for the purpose of Part 7 of Division B, the portion of a building,

a) that is situated between the top of any floor and the top of the floor next above it, or
b) that is situated between the top of the floor and the ceiling above the floor, if there is no floor above it.

STOP

12.3 MEZZANINES AND OPENINGS THROUGH FLOOR ASSEMBLIES (Articles 3.2.8.1. and 3.2.8.2.)

This section covers fire separation requirements for mezzanines and interconnected floors with the exception of atriums that require special protection measures in Articles 3.2.8.3. to 3.2.8.11. (covered in Module 13).

Article 3.2.8.1., "Application"

Sentence 3.2.8.1.(1) sets the stage for applying the requirements of Subsection 3.2.8., "Mezzanines and Openings Through Floor Assemblies".

All portions of a floor area or mezzanine are required to terminate at an exterior wall, a firewall, a vertical shaft, or a vertical fire separation having a fire-resistance rating not less than that required for the floor assembly, except as:

- permitted by the exceptions provided in Article 3.2.8.2. for: specific mezzanines, openings between floor levels of storage garages, openings for manufacturing processes, openings for stairs, escalators and walks, industrial platforms and walkways, and two-storey interconnected floor spaces consisting of the first storey and one adjacent storey, or

- permitted by the special protection requirements of Articles 3.2.8.3. through 3.2.8.11. (for atriums).

Sentence 3.2.8.1.(2) does not allow the exemptions in Sentence (1) to apply to the fire separation requirements for exits and vertical service spaces in Sections 3.4, 3.5 and 3.6. As such, exits and vertical service spaces are required to be fire separated as required in other parts of the Code.

Sentence 3.2.8.1.(3) does not permit sleeping rooms in a building of Group B, Division 2 or 3 major occupancy to be part of an interconnected floor space.

Sentences 3.2.8.1.(4) and (5) apply to an interconnected floor space within an elementary or secondary school as follows:

- The only type of interconnected floor space permitted is between the first storey and one adjacent storey.
- The interconnected floor space is sprinklered.
- The upper floor of the interconnected floor space is required to be fire separated from the interconnected floor space. A corridor on the upper floor of the interconnected floor space is required to be separated from the interconnected floor space by a fire separation with a minimum 30 min fire-resistance rating. Rooms and occupied spaces on the upper floor of the interconnected floor space are required to be separated from the interconnected floor space by a nonrated fire separation.
- A portion of a floor area that is not located within the interconnected floor space is not permitted to provide access to exit through the interconnected floor space.

Article 3.2.8.2., "Exceptions to Special Protection"

This Article is more commonly used since it applies to 'open' and 'enclosed' mezzanines, openings between floor levels of storage garages, openings for manufacturing processes, openings for stairs, escalators and walks, industrial platforms and walkways, and two-storey interconnected floor spaces consisting of the first storey and one adjacent storey.

Article 3.2.8.2. exempts mezzanines and interconnected floor conditions that comply with Article 3.2.8.2., from complying with the special protection requirements of Articles 3.2.8.3. through 3.2.8.11.

Sentence 3.2.8.2.(1) covers exemptions for five mezzanine conditions. The following mezzanines are not required to terminate at a vertical fire separation or be protected in compliance with Articles 3.2.8.3. through 3.2.8.11. (refer to Figure 12-1 that illustrates "aggregate area of mezzanines" and how they are determined).

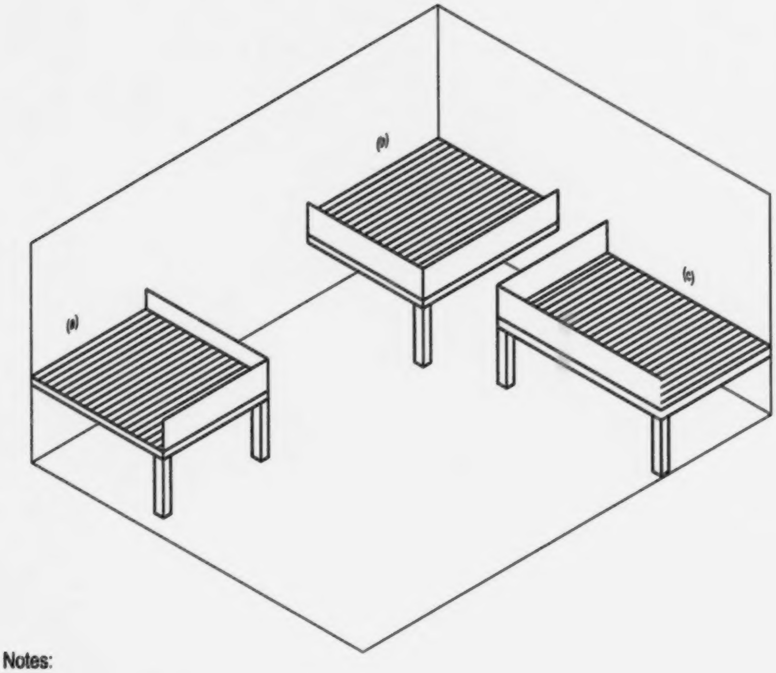
1. **Group A, Division 1[Clause 3.2.8.2.(1)(a)]**

   Mezzanines that serve a Group A, Division 1 major occupancy (assembly occupancies intended for the production and viewing of the performing arts).

2. **Group A, Division 3 [Clause 3.2.8.2.(1)(b)]**

   Mezzanines that serve a Group A, Division 3 major occupancy in a building not more than two storeys high (assembly occupancies of the arena type).

Aggregate Area of Mezzanines (at same level) [Sentence 3.2.8.2.(1)]



Notes:

1. Aggregate area= (a)+(b)+(c) of mezzanine.

2. Expressed as a % of:

   a) the open area of the room or storey in which it is located (Clause 3.2.1.1.(3)(a)) for 40% (open) mezzanine, or
   b) the suite in which it is located if there is more than one suite in the storey (Clause 3.2.1.1.(4)(a)) for 10% (enclosed) mezzanine, or
   c) the storey in which it is located (Clause 3.2.1.1.(4)(b)) for 10% (enclosed) mezzanine.

FIGURE 12-1

3. **Open Mezzanines [Clause 3.2.8.2.(1)(c)]**

   Mezzanines that are not considered a storey by Sentence 3.2.1.1.(3) or 3.2.1.1.(4).

   To be exempt from the fire separation requirements in Clause 3.2.8.2.(1)(c):

   - the mezzanine serves a Group A, C, D, E or F occupancy.

   Refer to Figure 12-2, "Library Bookshelves on a Mezzanine", Figure 12-3, "40% (Open) Mezzanine", and Figure 12-4, 40% (open) mezzanine including 10% (enclosed) mezzanine portion.

4. **Enclosed and Open Mezzanines [Clause 3.2.8.2.(1)(d)]**

   Mezzanines are not considered a storey by Sentence 3.2.1.1.(4) where the aggregate area of a mezzanine does not exceed 10% of the floor area in which it is located, and the area of the mezzanine in a suite does not exceed 10% of the area of that suite.

   To be exempt from the fire separation requirements in Clause 3.2.8.2.(1)(d):

   - the area of the mezzanine is not permitted to exceed 500 m^2, and
   - the mezzanine does not contain a Group B occupancy.

   Review Figures 12-5 and 12-6, "10% (Enclosed) Mezzanine".

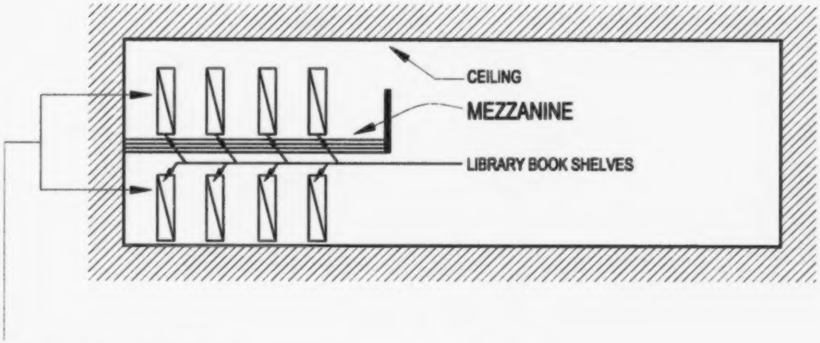
5. **Open Mezzanines with 10% enclosed area [Clause 3.2.8.2.(1)(e)]**

   Mezzanines not considered a storey by Sentence 3.2.1.1.(8).

   Review Figure 12-4.

STOP

Library Bookshelves on a Mezzanine [Sentence 3.3.2.11.(3)]

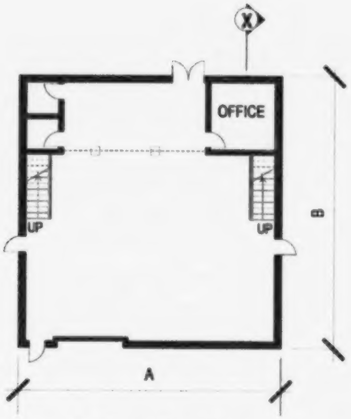

CEILING
MEZZANINE
LIBRARY BOOK SHELVES

Maximum Height of Bookshelves:

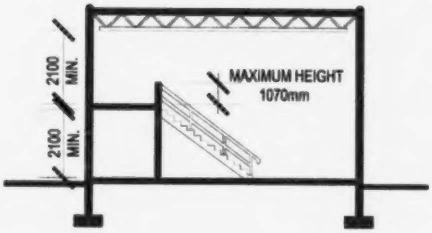
Up to 2100 mm but not more than 75% of the floor-to-ceiling height above or below the mezzanine.

FIGURE 12-2

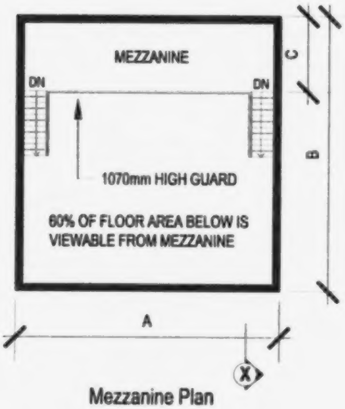
40% (open) Mezzanine [Clause 3.2.8.2.(1)(c) and Sentence 3.2.1.1.(3)]


X
OFFICE
UP
UP
B
A

1st Storey Floor Plan


2100 MIN.
2100 MIN.
MAXIMUM HEIGHT 1070mm

Section X-X


MEZZANINE
DN
DN
C
B
1070mm HIGH GUARD
60% OF FLOOR AREA BELOW IS VIEWABLE FROM MEZZANINE
A
X

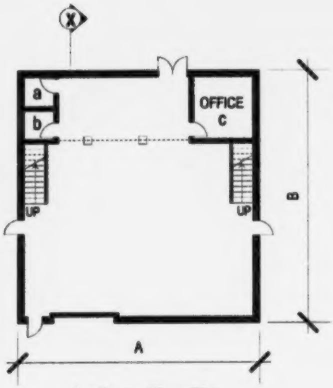
Mezzanine Plan

Notes:

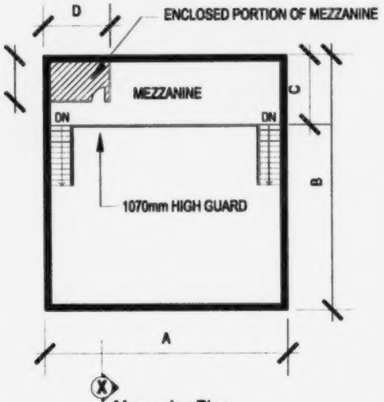
1. A x C ≤ 0.4(A x B)
2. Used as an open floor area.
3. Visual obstructions higher than 1070mm above mezzanine floor are not permitted except for open bookshelves in a library building.
4. Up to 40% of the area of the "room or suite" (Clause 3.2.1.1.(3)(a)).
5. If conditions are not met this creates a second storey for the purposes of building height calculation.

FIGURE 12-3

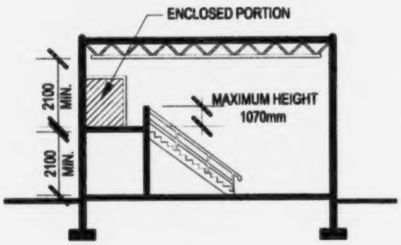
40% (open) Mezzanine Including 10% (enclosed) Mezzanine Portion [Clause 3.2.8.2.(1)(c) and Sentences 3.2.1.1.(3), (5) and (8)]


X
a
b
OFFICE
c
UP
UP
B
A

1st Storey Floor Plan


D
ENCLOSED PORTION OF MEZZANINE
E
MEZZANINE
C
DN
DN
B
1070mm HIGH GUARD
A
X

Mezzanine Plan


ENCLOSED PORTION
2100 MIN.
2100 MIN.
MAXIMUM HEIGHT 1070mm

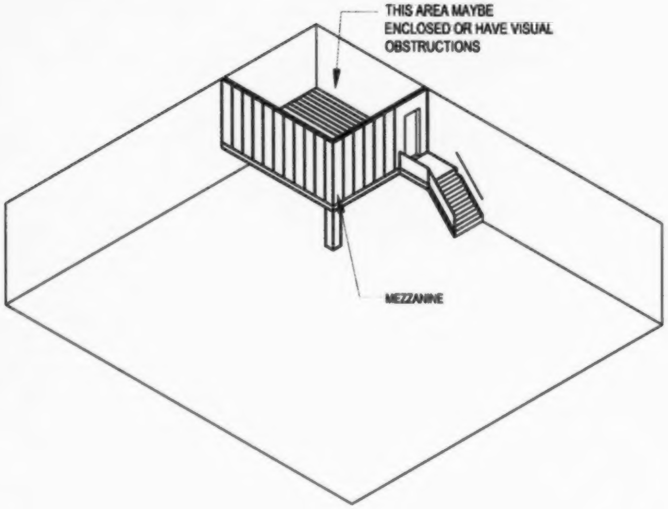
Section X-X

Notes:

1. Used as an open floor area with 10% enclosed. Enclosed portion of mezzanine does not visually obstruct open floor area.
2. $A \times C \leq 0.4\{(A \times B) - [a + b + c]\}$
3. $D \times E \leq 0.1\{(A \times B) - [a + b + c]\}$
4. Visual obstructions higher than 1070mm above mezzanine floor are not permitted except in libraries as permitted by Sentence 3.3.2.11.(3).
5. Up to 40% of the open area of the "room or suite" (Clause 3.2.1.1.(3)(a)).
6. If conditions are not met this creates a second storey for the purposes of building height calculation.

FIGURE 12-4

10% (enclosed) Mezzanine [Clause 3.2.8.2.(1)(d) and Sentence 3.2.1.1.(4)]


THIS AREA MAYBE ENCLOSED OR HAVE VISUAL OBSTRUCTIONS
MEZZANINE

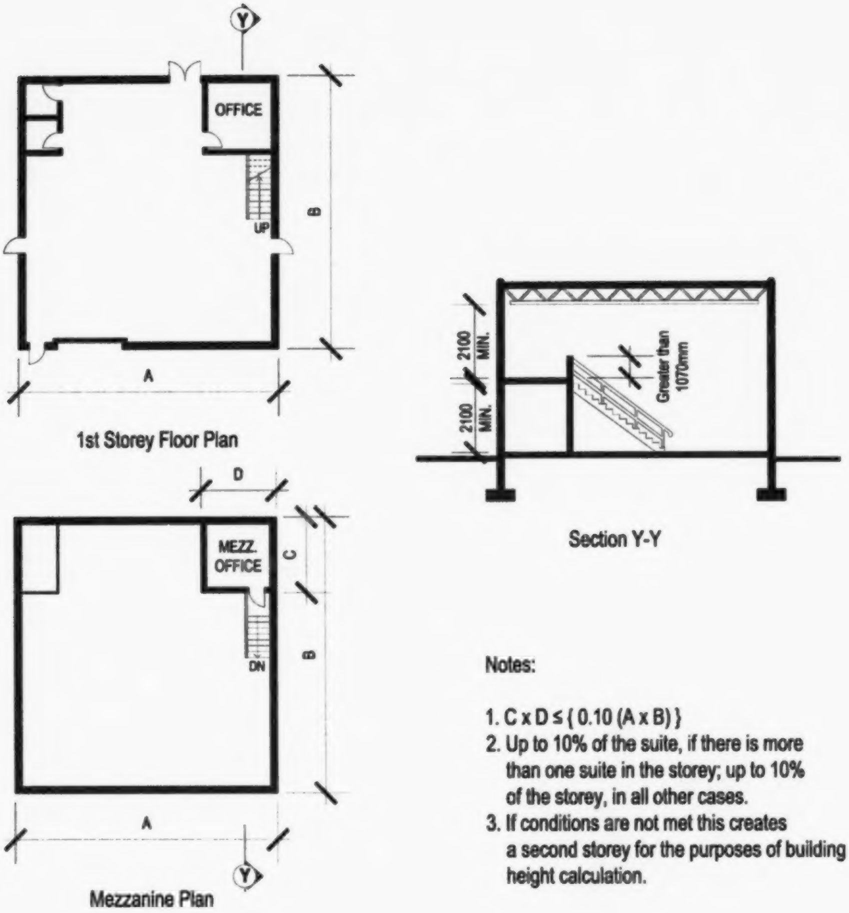
Note:

- maximum 500m2
- cannot be 'B' occupancy

Note:
- maximum 500 m^2
- can not be 'B' occupancy

FIGURE 12-5

10% (Enclosed) Mezzanine [Clause 3.2.8.2.(1)(d) and Sentence 3.2.1.1.(4)]


Y
OFFICE
UP
B
A
D
MEZZ. OFFICE
C
B
DN
A
Y
2100 MIN.
2100 MIN.
Greater than 1070mm

1st Storey Floor Plan

Mezzanine Plan

Section Y-Y

Notes:

1. C x D ≤ { 0.10 (A x B) }
2. Up to 10% of the suite, if there is more than one suite in the storey; up to 10% of the storey, in all other cases.
3. If conditions are not met this creates a second storey for the purposes of building height calculation.

FIGURE 12-6

Storage Garage

Sentence 3.2.8.2.(2) permits openings between floor levels of a storage garage. However, the floor assembly above a basement storage garage that is considered a separate building by Article 3.2.1.2. is not permitted to have unprotected openings.

Industrial Process Openings

Sentence 3.2.8.2.(3) allows openings in fire separations that if provided with a closure would disrupt a manufacturing process. However, precautions are required to be taken to compensate for the resulting hazard.

Detention Occupancies

Sentence 3.2.8.2.(4) allows an interconnected floor space in a Group B, Division 1 occupancy that consists of any two adjacent storeys, but does not restrict one of those storeys as the first storey of the building.

Stair, Escalator and Walkway Openings

Sentence 3.2.8.2.(5) applies specifically to stairs, escalators or walks. To apply this requirement, the building must be sprinklered and the interconnected floor space is restricted to any Assembly occupancy, Group D and Group E occupancies and the opening size for the stairs, escalator or walk does not exceed 10 m^2 in area.

Two Interconnected Storeys

Sentence 3.2.8.2.(6) applies to buildings with the following:

- the first storey and the storey above or below, but not both, are interconnected
- sprinklered interconnected floor space, and
- contains only A1, A2, A3, D, E or F3 occupancies.

STOP

EXERCISE #12-1

1. Which of the following shall not be constructed as part of an interconnected floor space? Give Code reference.

   a) A floor area containing sleeping rooms

   b) A floor area containing washrooms

   c) a floor area containing sleeping rooms in a building of B2 or B3 major occupancy

   d) A floor area containing sleeping rooms in a building of Group B major occupancy.

   ________________________[____________]

2. A mezzanine does not need to terminate at a vertical fire separation nor be protected in conformance with Articles 3.2.8.3. to 3.2.8.11. provided the mezzanine (give Code reference):

   a) serves a Group C occupancy

   b) serves a Group A, Division 3 major occupancy in a building not more than three storeys in building height

   c) serves a Group A, Division 1 major occupancy

   ________________________[____________]

STOP

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PARTICIPANT MODULE 13

COMPLEX BUILDINGS - 2006

INTERCONNECTED FLOOR SPACES

PART 2

Objectives

Upon completion of this module, you should be able to:

- state the ways in which provisions of the Code relate to how openings through floor construction are exempted from requirements pertaining to the general concept of compartmentation.
- locate the various provisions of the Code relating to interconnected floor spaces.

For each type of permitted opening, the Code specifies conditions to ensure that the level of safety for building occupants is consistent with other provisions in the Code.

Configuration of Floor Openings (3.2.8.3.)

Article 3.2.8.3. describes the acceptable configuration of a floor opening in an interconnected floor space. The purpose of the requirement is to allow the smoke to rise without spilling into the floor areas above the fire floor and to facilitate effective smoke exhaust.

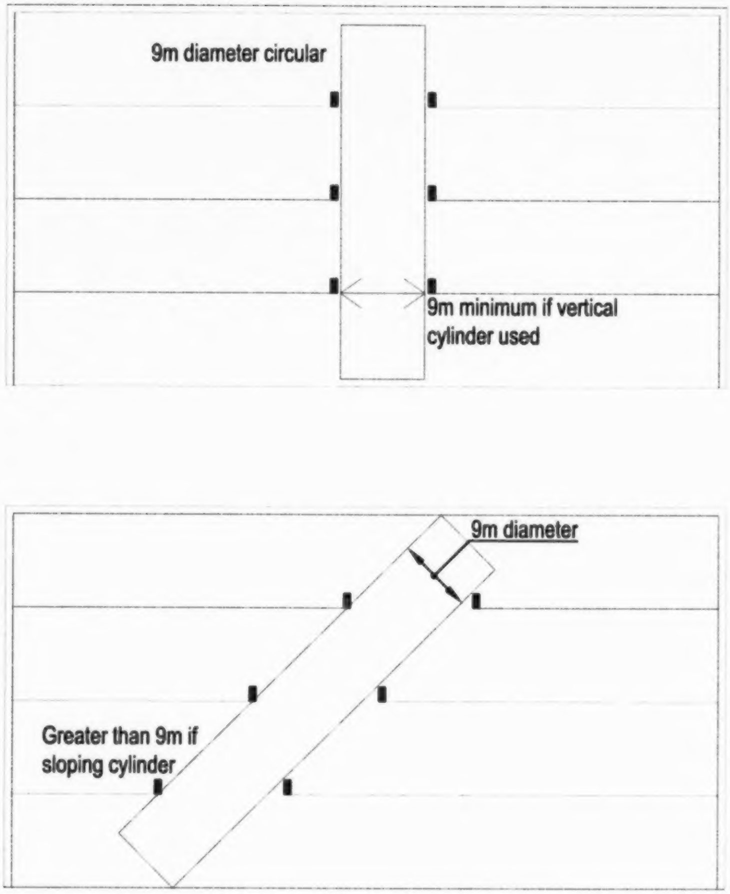
According to Article 3.2.8.3., an unprotected opening through a floor assembly must be of a size and shape adequate to accommodate a full height circular or elliptical cylinder of at least the following dimensions:

- Circular cylinder - 9 m in diameter
- Elliptical cylinder - cross-sectional area of 65 m^2, at least 7 m along the minor axis.

This requirement does not apply to floor openings regulated by Article 3.2.8.2.

Refer to Figure 13-1 for an illustration of the circular cylinder.

Sentence 3.2.8.3.(2)


9m diameter circular
9m minimum if vertical cylinder used
9m diameter
Greater than 9m if sloping cylinder

Note:
Cannot stagger the 9m diameter cylinder

FIGURE 13-1

Exits from Interconnected Floor Spaces (3.2.8.4.)

Sentence 3.2.8.4.(5) states that exits must lead directly to the building exterior without passing through an interconnected floor space. Access to exits for protected floor areas must likewise not lead through any interconnected floor space (see Figure 13-2). Nor is exiting through a lobby allowed when the lobby is located within an interconnected floor space [3.4.4.2.(2)(d)] (this restriction does not apply to conditions regulated by Sentence 3.2.8.2.(6)).

The increased travel distance to exits permitted for a sprinklered floor area cannot be applied to the interconnected floor space except at the ground level [3.2.8.4.(4)]. For example, the maximum allowable travel distance to an exit in an unsprinklered Group D (office) occupancy is 40 m rather than 45 m [3.4.2.5.(1)(b)].

In buildings in which the floor level of the top storey is more than 18 m above grade, exit stairs opening into an interconnected floor space must be designed to limit contamination by smoke to no more than 1% by volume in a 2 h period after the start of the fire [3.2.8.4.(1)].

In buildings with the floor level of the top storey more than 75 m above grade, a pressurized or vented vestibule must be provided between an exit stair shaft and the interconnected floor space (see Figure 13-3). The vestibule shall be designed in conformance with Sentence 3.2.8.4.(3) (see Figure13-4).

The treads, landings and floor surface of exits serving an interconnected floor space more than 18 m above grade must be sufficient for temporary refuge of all occupants (total occupant load) within the exits (0.3 m^2 per occupant). The objective of Sentence 3.2.8.4.(6) is to provide an area of temporary safety in the exit stair shafts for occupants of the interconnected floor space. The two alternatives to Sentence 3.2.8.4.(6) are cumulative exit width and floor areas separated from the interconnected floor space by a fire separation having at least a 1 h fire-resistance rating (0 h in Light Hazard occupancies per NFPA 13) [3.2.8.4.(6),(7),(8)].

Protected Floor Spaces (3.2.8.4.(5))

A floor area separated from an interconnected floor space by a fire separation having a fire-resistance rating equal to that required for the floor assembly of the storey on which it is located (see Figure 13-2) is not considered to be part of the interconnected floor space.

A condition of using a protected floor space is that the occupant does not have to re-enter the interconnected floor space in order to reach the outside of the building. Also, note that in the case of a floor space containing Group B major occupancy sleeping rooms, Article 3.2.8.6 requires that a vestibule be added between the separated floor area and any access into the interconnected floor space.

Floor areas not located within an interconnected floor space must have access to the required exits without travel through the interconnected floor space [3.2.8.4.(5)].

STOP

Protected Floor Spaces

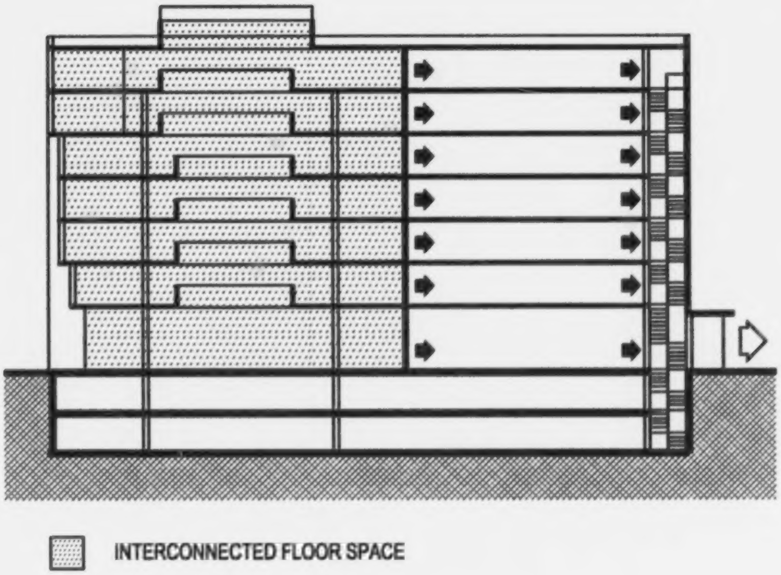

INTERCONNECTED FLOOR SPACE

FIGURE 13-2

Sentence 3.2.8.4.(2)

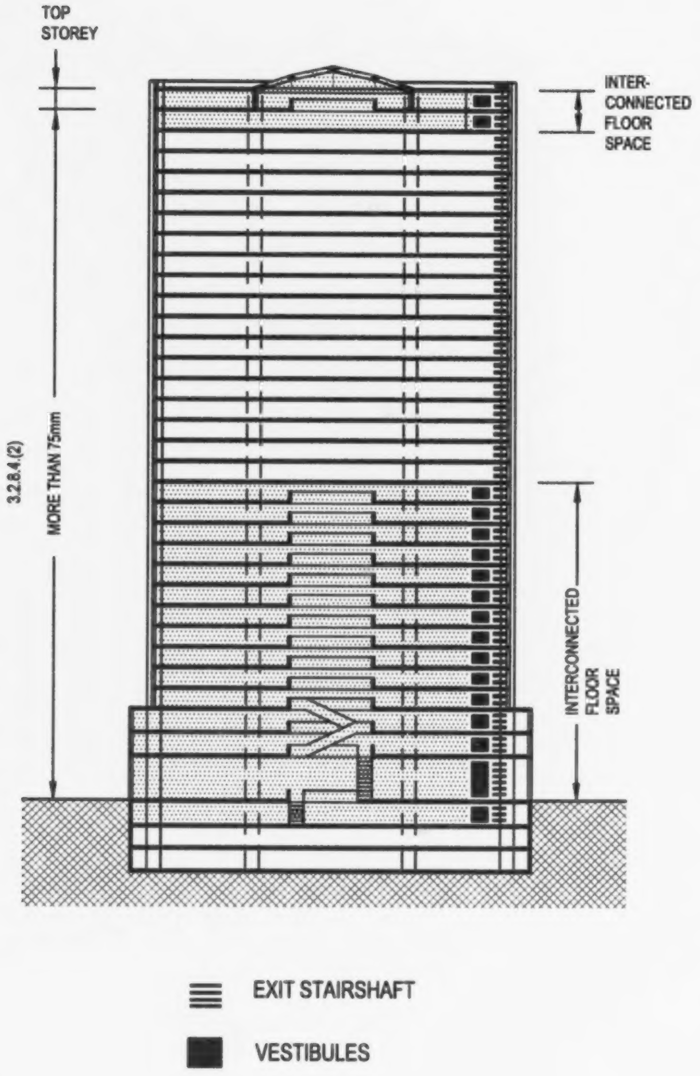
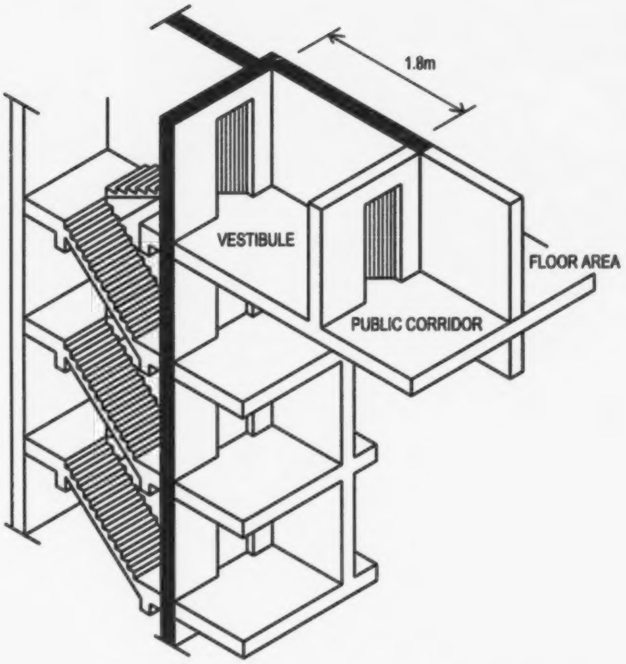

TOP STOREY
INTER-CONNECTED FLOOR SPACE
3.2.8.4.(2)
MORE THAN 75mm
INTERCONNECTED FLOOR SPACE
EXIT STAIRSHAFT
VESTIBULES

FIGURE 13-3

Sentence 3.2.8.4.(2)


1.8m
VESTIBULE
FLOOR AREA
PUBLIC CORRIDOR

☐ 45 min FIRE SEPARATION

■ RATING AS REQUIRED FOR EXIT STAIR

VESTIBULE
-PRESSUIRIZED MECHANICALLY OR
VENTED TO THE OUTDOORS

FIGURE 13-4

EXERCISE #13-1

1. In a sprinklered 10-storey office building (Article 3.2.2.49) containing an interconnected floor space that consists of storeys one through four, what is the travel distance limit on the third storey?

   ____

   ____________________________ [____________]

2. In the office building described above, if a portion of the fourth storey is separated from the interconnected floor space by a 2 h fire separation and has access to two exits without travelling through the interconnected floor space, what is the travel distance limit for that portion of the fourth storey?

   ____

   ____________________________ [____________]

3. In the office building described in Question 1, what is the travel distance limit for the first storey having exterior exit doors at ground level?

   ____

   ____________________________ [____________]

4. In Sentence 3.2.8.4.(6), the required minimum area of temporary refuge provided by stair treads and landings for an occupant load of 240 persons is:

   a) 48 m^2
   b) 72 m^2
   c) 100 m^2
   d) 120 m^2

   ____

   ____________________ [__________]

STOP

Elevators (3.2.8.5.)

In buildings with storeys more than 18 m above grade, pressurized vestibules must be provided for elevator doors, if the elevator shaft opens into an interconnected floor space or into storeys above the interconnected floor space, to minimize smoke migration from fire in the interconnected floor space to the storeys above the interconnected floor space. Two options are:

- Provide vestibules at elevator doors opening into the interconnected floor space, except the lowest storey of the interconnected floor space (see Figure 13-5), or

- Provide vestibules at elevator doors opening into storeys above the interconnected floor space (see Figure 13-6).

The vestibule must conform to Sentences 3.2.8.4.(1) and 3.2.8.4.(3) (see Figure 13-4).

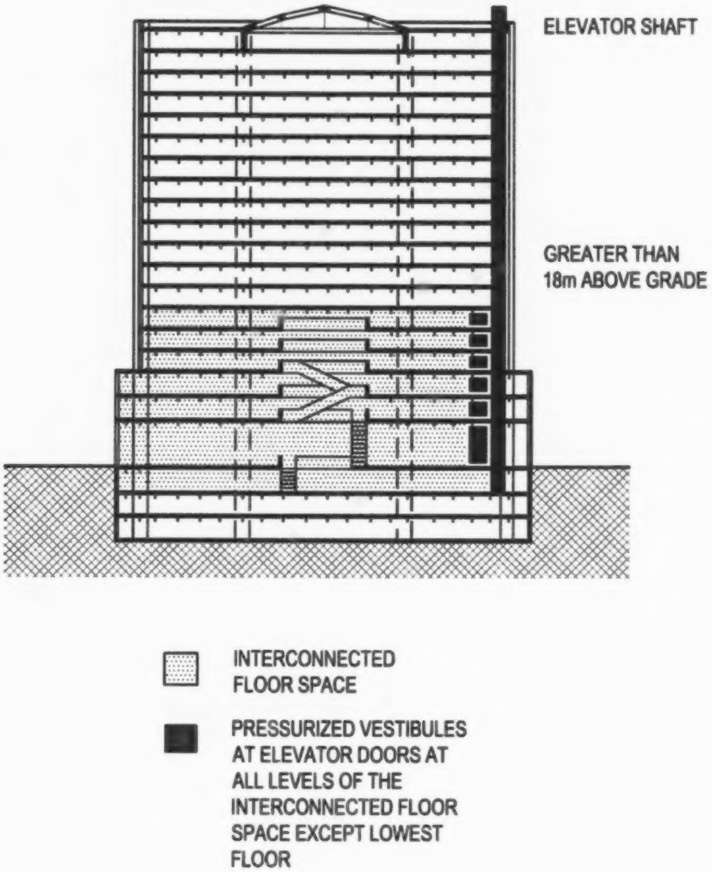

ELEVATOR SHAFT
GREATER THAN 18m ABOVE GRADE
▨ INTERCONNECTED FLOOR SPACE
■ PRESSURIZED VESTIBULES AT ELEVATOR DOORS AT ALL LEVELS OF THE INTERCONNECTED FLOOR SPACE EXCEPT LOWEST FLOOR

FIGURE 13-5

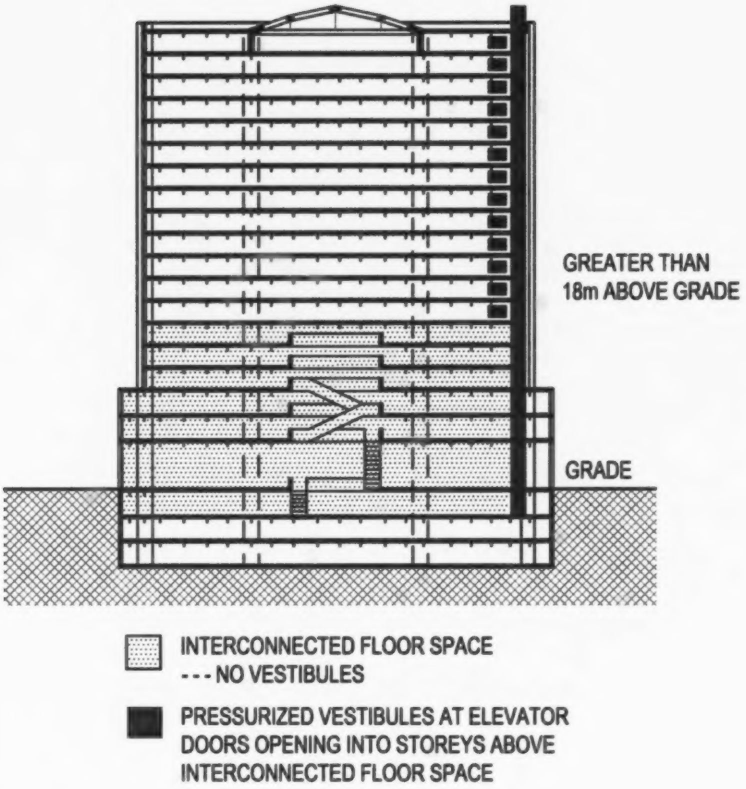

GREATER THAN
18m ABOVE GRADE
GRADE
INTERCONNECTED FLOOR SPACE
- - - NO VESTIBULES
PRESSURIZED VESTIBULES AT ELEVATOR DOORS OPENING INTO STOREYS ABOVE INTERCONNECTED FLOOR SPACE

FIGURE 13-6

EXERCISE #13-2

1. In Article 3.2.8.5., is it acceptable to pressurize the elevator shaft in lieu of elevator door vestibules that are pressurized in an emergency?

   ____

   ______________________________[__________]

2. Elevator vestibules are required when the building is more than __ m high, measured from the floor level of the top storey to grade:

   a) 18 m
   b) 25 m
   c) 36 m
   d) 75 m

   ______________________________[__________]

3. What are the two options for the location of elevator vestibules?

   ____

   ____

   ______________________________[__________]

STOP

Special Requirements for Institutional Buildings - Group B, Division 2 (3.2.8.6.)

Sleeping rooms must not be located within an interconnected floor space (Sentence 3.2.8.1.(3)]. Access between an interconnected floor space and sleeping areas must be through pressurized vestibules in order to restrict the passage of smoke from the interconnected floor space into the sleeping areas (see Figure 13-7).

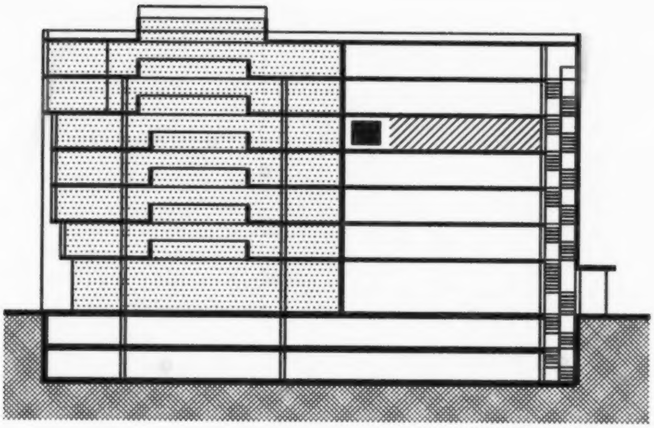
Sprinkler Systems (3.2.8.7.)

Storeys that are wholly or partially within an interconnected floor space must be sprinklered. All storeys below an interconnected floor space must also be sprinklered (see Figure 13-8) [3.2.8.7.(1)].

The sprinkler systems must be electrically supervised by the fire alarm system. The fire alarm system must be monitored by an independent central station [3.2.8.7.(2)].

According to NFPA 13, closely-spaced (1.8 m spacing) sprinklers in combination with minimum 457 mm deep noncombustible draft stops must be provided around the underside of floor openings, except where the floor opening is not less than 93 m^2 in area and more than 6 m between opposite edges of the opening. The sprinklers must be located between 152 mm and 305 mm from the draft stops. Where sprinklers are spaced less than 1.8 m on centre,
cross baffles must be installed to prevent cold solder (i.e. wetting of adjacent sprinkler).

STOP



░ INTERCONNECTED FLOOR SPACE

▨ GROUP B SLEEPING ROOMS
NOT PART OF INTERCONNECTED FLOOR SPACE

■ PRESSURIZED VESTIBULE OPENING INTO INTERCONNECTED FLOOR SPACE

FIGURE 13-7

Article 3.2.8.7.

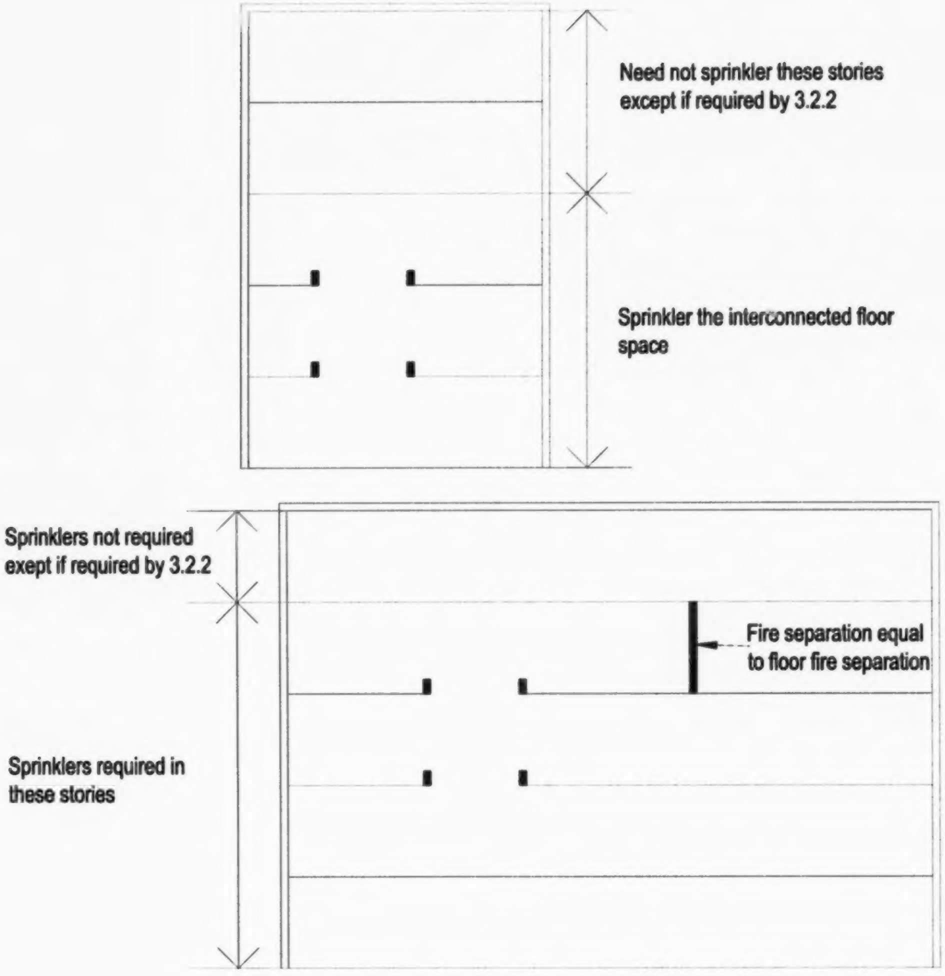

Need not sprinkler these stories except if required by 3.2.2
Sprinkler the interconnected floor space
Sprinklers not required exept if required by 3.2.2
Fire separation equal to floor fire separation
Sprinklers required in these stories

FIGURE 13-8

EXERCISE #13-3

1. Which storeys are required to be sprinklered in a 16-storey office building (that is not a high building) containing an interconnected floor space consisting of storeys 1 through 5? The building includes three basement levels.

   a) storeys 1 through 5

   b) storeys 1 through 16

   c) storeys 1 through 5 and 1 basement level

   d) storeys 1 through 5 and 3 basement levels

   ______________________________[____________________]

Fire Alarm and Detection Systems (3.2.8.8.)

Article 3.2.8.8. requires that a fire alarm system and electrically supervised annunciator be provided in a building containing an interconnected floor space. The fire alarm system must be capable of notifying the fire department either directly or through a monitoring station.

In addition to the detection required under Subsection 3.2.4., smoke detectors must be provided at the ceiling level adjacent to the floor openings, and as required to activate the smoke control system.

Smoke Control (3.2.8.9.)

Smoke control systems in interconnected floor spaces are intended to prevent the spread of smoke from one storey to another storey in a building where the fire separation between storeys is penetrated by an opening. Additional benefits of smoke control may include:

- Maintains a tenable environment in the means of egress during the time required for evacuation.
- Controls and reduces the migration of smoke between the fire area and adjacent spaces.
- Provides conditions within and outside the fire zone that will assist emergency response personnel to conduct search-and-rescue operations and to locate and control the fire.
- Contributes to the protection of life and reduction of property loss.
- Aids in post-fire smoke removal.

The provision of a smoke control system in an interconnected floor space involves:

- Installation of an automatic sprinkler system.

- Pressurization of exit stair shafts or stair door vestibules (in certain conditions).

- Provision of vented or pressurized elevator vestibules (in certain conditions).

- Stoppage of air exhaust or recirculating fans serving the interconnected floor space.

- Provision of a mechanical exhaust system designed to extract smoke from the fire floor, and to limit the migration of smoke from the fire floor to other floor areas within the interconnected floor space, or to sufficiently exhaust smoke from the top of the opening interconnecting the floors [3.2.8.9.(3)].

The smoke control system must be activated upon actuation of the sprinkler system or upon detection of smoke by at least two smoke detectors within a single zone. Sentences 3.2.8.9.(3) and (4) require that three things happen:

- The fan equipment for the pressurization of exit stair shafts, elevator vestibules and special area vestibules (e.g. sleeping areas of B2 occupancy) must be initiated.

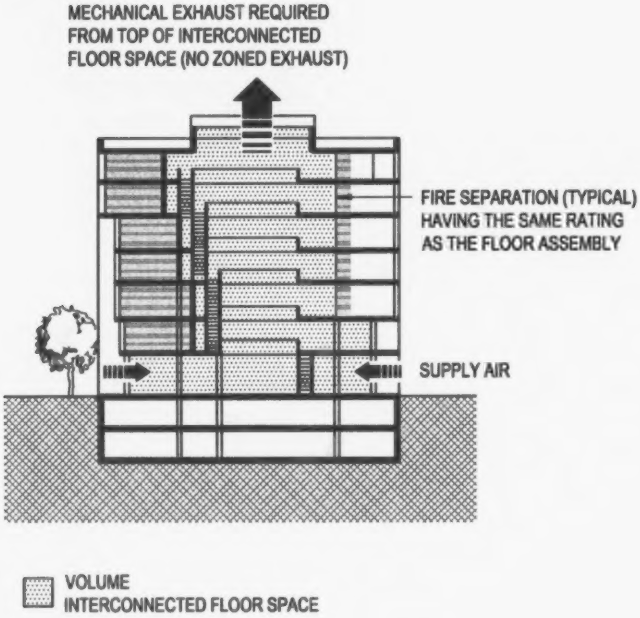
- Air moving fans for the interconnected floor space must be stopped.

- Mechanical fans must be activated to exhaust the smoke, to provide makeup air, and to pressurize floor areas to limit the movement of smoke from the fire floor into storeys above.

Smoke Extraction

According to Sentence 3.2.8.9.(6), a smoke control system must include mechanical exhaust at the top of the interconnected floor space, capable of producing six air changes per hour. If the volume of the interconnected floor space is more than 17,000 m^3, only four air changes per hour must be provided (see Figure 13-9).

Protected floor areas separated from the interconnected floor space may be excluded in the exhaust volume calculations, (assuming that the high-rise measure being used only deals with the atrium) also floor areas that are designed to be directly exhausted (or zone exhausted) [3.2.8.9.(4) and (5)].


MECHANICAL EXHAUST REQUIRED FROM TOP OF INTERCONNECTED FLOOR SPACE (NO ZONED EXHAUST)
FIRE SEPARATION (TYPICAL) HAVING THE SAME RATING AS THE FLOOR ASSEMBLY
SUPPLY AIR
VOLUME INTERCONNECTED FLOOR SPACE

RATES OF EXHAUST:
6 AIR CHANGES PER HOUR
IF THE VOLUE IS LESS
THAN $17000 m^3$
4 AIR CHANGES PER HOUR
IF THE VOLUME IS GREATER
THAN $17000 m^3$

FIGURE 13-9

Direct (zoned) mechanical exhaust of the floor area of the origin of the fire is permitted by Sentence 3.2.8.9.(4). The rate of exhaust must be at least six air changes per hour (see Figure 13-10).

Note that exhausting air cannot be done effectively without supplying air at the same time. The supply air must be introduced in sufficient quantities and at appropriate locations in order to facilitate effective exhaust and to prevent the movement of smoke from the fire floor to floors above.

The following publications provide valuable guides for the design of smoke control systems:

- NFPA 92A, "Recommended Practice for Smoke Control Systems"
- NFPA 92B, "Guide for Smoke Management Systems in Malls, Atria and Large Areas"
- ASHRAE 1992 Design Manual, "Design of Smoke Management Systems", by J. Klote and J. Milke

Testing

Required smoke control systems and the pressurization or venting systems of protective vestibules must be tested to ensure satisfactory operation [Article 3.2.8.11.].

STOP

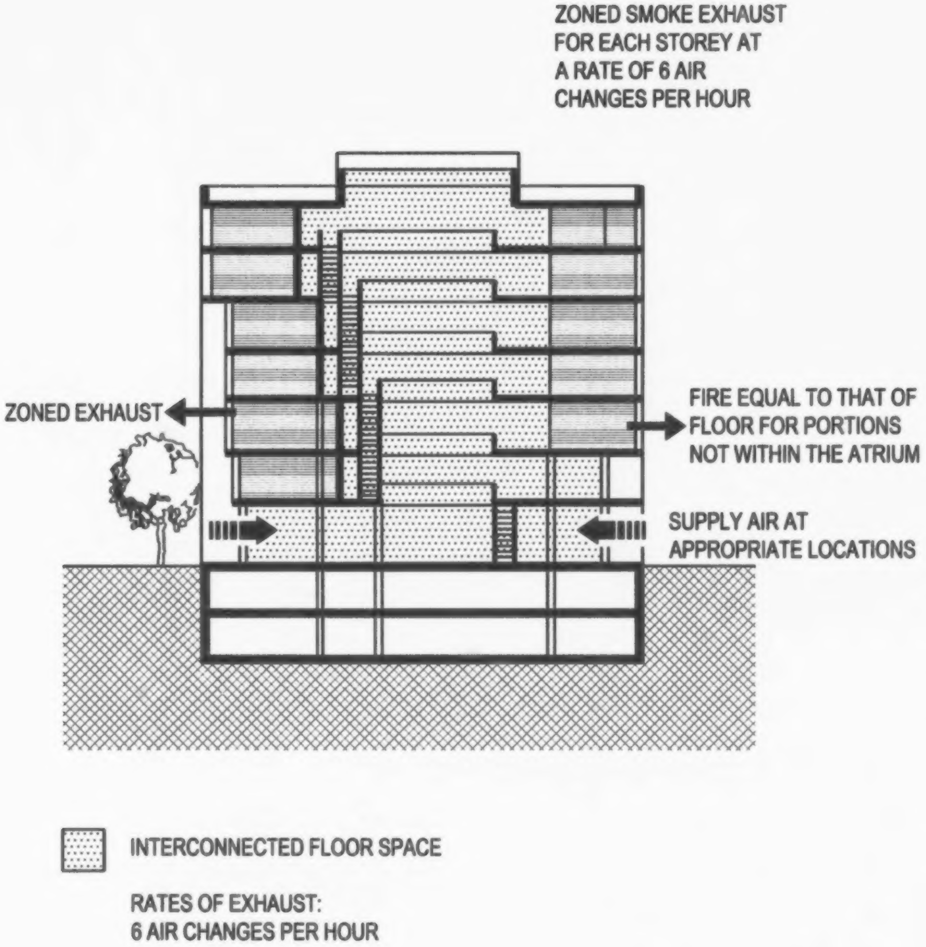

ZONED SMOKE EXHAUST
FOR EACH STOREY AT
A RATE OF 6 AIR
CHANGES PER HOUR
ZONED EXHAUST
FIRE EQUAL TO THAT OF
FLOOR FOR PORTIONS
NOT WITHIN THE ATRIUM
SUPPLY AIR AT
APPROPRIATE LOCATIONS
▨ INTERCONNECTED FLOOR SPACE
RATES OF EXHAUST:
6 AIR CHANGES PER HOUR

FIGURE 13-10

EXERCISE #13-4

1. If the volume of an interconnected floor space with mechanical exhaust at the top is 15,000 m^3, how many air changes per hour are required?

   a) 2
   b) 4
   c) 6
   d) 8

   ______________________________ [________________]

2. If the volume in item 1 above is 20,000 m^3, how many air changes per hour are required?

   a) 2
   b) 4
   c) 6
   d) 8

   ______________________________ [________________]

3. If the total volume of an interconnected floor space is 34,000 m^2, comprised of zoned exhaust at 16,000 m^3 and atrium exhaust at 18,000 m^3, how many air changes are required for the atrium?

   a) 2
   b) 4
   c) 6
   d) 8

   ______________________________ [________________]

How many air changes are required for the floor area zoned exhaust?

a) 2
b) 4
c) 6
d) 8

______________________________ [______________]

4. Are smoke detectors required at the top of an atrium?

____

____

______________________________ [______________]

STOP

Emergency Power (3.2.8.10.)

Where the top storey of a building containing an interconnected floor space is more than 18 m above grade, emergency power must be provided for the operation of the smoke control system for at least 2 hours. This requirement applies whether or not the building is a high-rise building, under Subsection 3.2.6.

STOP

EXERCISE #13-5

1. The top storey of a building containing an interconnected floor space is 18 m above grade. What is the required duration of emergency power for the operation of the smoke control systems (not considering Articles 3.2.6.2. and 3.2.6.10.)?

   a) 2 h
   b) 1 h
   c) 30 minutes
   d) 0 h

   ______________________ [______________________]

STOP

EXERCISE #13-6

Read Article 3.2.8.9. Compare the top-exhaust method to the zoned-exhaust method of smoke control by completing the following chart. Class discussion begins in 20 minutes.

	Top-Exhaust System	Zoned-Exhaust System
Climactic design conditions for the smoke control system based on		
Smoke control system activated by		
Number of air changes per hour for volumes less than 17,000 m^3		
Number of air changes per hour for volumes more than 17,000 m^3		
Location of manual override controls for fire department		

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 14

COMPLEX BUILDINGS - 2006

STRUCTURAL DESIGN

HEAT, VENTILATING AND AIR CONDITIONING

PLUMBING

HOUSING AND SMALL BUILDINGS

RESOURCE CONSERVATION

MODULE 14 STRUCTURAL DESIGN
HEATING, VENTILATING AND AIR CONDITIONING
PLUMBING
HOUSING AND SMALL BUILDINGS
RESOURCE CONSERVATION

14.1 INTRODUCTION

Even though the majority of the Complex Building course is dedicated to requirements found in Division B, Part 3, a number of additional requirements related to fire protection, health and safety objectives are found in other parts of Division B.

This module will cover requirements found in the following additional parts of Division B:

Part 4 - Structural Design
Part 6 - Heating, Ventilating and Air Conditioning
Part 7 - Plumbing
Part 9 - Housing and Small Buildings
Part 12 - Resource Conservation

In addition, materials in Supplementary Standards SB-1 and SB-10, which are referred to in the above parts of the Code, will be addressed in this module.

Objectives

Upon completion of this module you will be able to:

- Provide an understanding of the loading requirements for guards.
- Provide an understanding of the requirements for fireplaces, materials in air duct systems, ducts, duct coverings, linings and insulation materials used in duct systems and return air plenums, clearances between combustible materials and pipes carrying steam or hot water, carbon monoxide alarms and chimneys.

- Provide an understanding of the requirements relating to plumbing facilities, including location of plumbing fixtures, and water temperature control for potable water systems.
- Understand and apply the provisions of the Code relating to measurement of floor areas for dwelling units, ceiling heights, and living areas within dwelling units.
- Understand and apply the provisions of the Code related to doors to bathrooms, glass in doors and sidelights, minimum window and glass areas for rooms in buildings of residential occupancy, the design and construction of interior and exterior stairs, steps, ramps, railings and guards, and lighting outlets.
- Provide an understanding of the Code requirements relating to resource conservation in the design and construction of buildings, including energy efficiency design, and energy efficiency design requirements for which a building permit has been applied for after December 31, 2011, motion sensors, and water efficiency.
- Reference applicable standards.

14.2 STRUCTURAL DESIGN (Subsection 4.1.5.)

In addition to the requirements for loads on handrails which are covered in Sentence 3.4.6.4.(9), Article 4.1.5.15. prescribes the design requirements for guards based on their minimum specified horizontal load, applied either inward or outward at the top of every required guard for:

a) means of egress in grandstands, stadiums, bleachers and arenas,
b) equipment platforms contiguous stairs and other areas where the gathering of people is improbable and for all other locations of guards [4.1.5.15.(1].

Individual elements within the guard such as solid panels and pickets must be designed to withstand a load of 0.5 kN applied over an area of 100 x 100 mm. The point located must be selected to produce the most critical effect on the guard [4.1.5.15.(2)].

The minimum specified load applied vertically at the top of every required guard shall be 1.5 kN/m and does not need to be considered to act simultaneously with the load in Sentence (1) of Article 4.1.5.15. [4.1.5.15.(4)].

The loads required for individual elements do not need to be considered to act simultaneously with the loads provided in Sentences (1) and (4) of Article 4.1.5.15. [4.1.5.15.(3)]

Walls Acting as Guards

Sentence 4.1.5.17.(1) indicates where floor elevation on one side of a wall is more than 600 mm higher than the elevation on the other side, the wall must be designed to resist lateral design loads prescribed in Section 4.1 ("Structural Loads and Procedures") or 0.5 kPa, whichever load produces the most critical effect.

14.3 DESIGN AND INSTALLATION OF HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS

Fireplaces (Article 6.2.1.5.)

According to Sentence 6.2.1.5.(1), fireplaces must conform to the requirements of Section 9.22.

Section 9.22 provides requirements for masonry fireplaces and includes provisions for the masonry and concrete used [9.22.1.2.], footings [9.22.1.3.], combustion air [9.22.1.4.], fireplace liners comprising fire brick or steel [Subsection 9.22.2.]; fireplace walls [Subsection 9.22.3.], the distance from the back of the fire chamber to the plane of the fireplace opening shall be not less than 300 mm [9.22.4.1.(1)], design of the hearth [9.22.5.], the required dampers and size of damper [9.22.6.1.(1)], the slope of the smoke chamber and wall thickness of the smoke chamber [9.22.7.].

Factory built fireplaces must conform to CAN/ULC-S610 "Factory Built Fireplaces" [9.22.8.1.(1)]. Clearances to combustible materials are described for fireplaces in Sentences 9.22.9.1 (clearance to fireplace opening); 9.22.9.2 metal exposed to the interior, 9.22.9.3 clearances to combustible framing, and 9.22.9.4 heat circulating duct openings.

Fireplace inserts and hearth mounted stoves must be vented through the throat of a fireplace and conform to the Standard ULC-S628, "Fireplace Inserts". The installation of fireplace inserts and hearth mounted stoves vented through the throat of a fireplace shall conform to CAN/CSA-B365, "Installation Code for Solid Fuel Burning Appliances and Equipment" [9.22.10].

Materials in Air Duct Systems (Subsections 6.2.3. and 6.2.4.)

All ducts, duct connectors and associated fittings and plenums used in air duct systems must be constructed of steel, aluminum alloy, copper, clay, asbestos cement, or similar noncombustible material with the following exceptions [6.2.3.2.(1)]:

Ducts, their fittings and plenums may contain certain combustible materials provided [6.2.3.2.(2)]:

a) they meet requirements for Class 1 duct materials in CAN/ULC-S110-M,
b) conform to Article 3.1.5.15. in a building required to be of noncombustible construction,
c) conform to Subsection 3.1.9., "Building Services in Fire Separations and Fire Rated Assemblies",
d) are used only in horizontal runs in a noncombustible building,
e) are not used in vertical runs serving more than two storeys in buildings required to be of noncombustible construction, and
f) are not used in air duct systems in which the air temperature may exceed 120°C.

Duct sealants are permitted provided they have a flame spread rating of not more than 25 and a smoke developed classification of not more than 50 [6.2.3.2.(3)].

Duct connectors between ducts and air outlets may contain combustible materials provided [6.2.3.2.(4)]:

a) they conform to requirements for Class 1 air duct materials in CAN/ULC-S110-M,
b) are limited to 4 m in length,
c) are used only in horizontal runs, and
d) do not penetrate required fire separations.

If the air duct materials are used in locations subject to excessive moisture, they shall show no appreciable loss of strength and must be corrosion resistant [6.2.3.2.(5)]. All ductwork and fittings shall be constructed and installed in accordance with SMACNA Manuals and ASHRAE Handbooks [6.2.3.2.(6)].

Requirements for duct lining covering adhesives and insulation are detailed in Article 6.2.3.4. These requirements include the use of noncombustible materials when exposed surface temperature is likely to exceed 120°C, limits on flame spread ratings and smoke developed ratings, requirements to comply with the Hot Surface Performance Test Standard ASTM-C411 for coverings and linings, restrictions on foamed plastic insulations used as part of an air duct system, and requirements for terminating linings and coverings near heat sources and where ducts penetrate a fire separation.

Air ducts that are typically used for return air are referred to in the Code as 'low capacity systems'. These requirements are detailed in Subsection 6.2.4. The requirements for coverings, linings and insulation used in return air systems are found in Article 6.2.4.8.

Piping for Heating and Cooling Systems (Subsection 6.2.9.)

Table 6.2.9.3. prescribes the clearance between steam or hot water pipes and combustible materials based on the temperature of the steam or water being carried through the pipes. Steam or hot water radiators cannot have an exposed surface temperature in excess of 70°C, unless precautions are taken to prevent human contact [6.2.9.4.(1)].

Carbon Monoxide Alarms (Subsection 6.2.12.)

Carbon monoxide alarms are required in every building that contains a residential occupancy, a fuel fired appliance or a storage garage [6.2.12.1.(1)].

Where fuel burning appliances are installed in a suite of residential occupancy, a carbon monoxide alarm must be installed adjacent to each sleeping area in the suite [6.2.12.2.(1)]. Where a fuel burning appliance is installed in a service room that is not in a suite of residential occupancy, a carbon monoxide alarm must be installed adjacent to each sleeping area in every suite of residential occupancy adjacent to the service room and in the service room [6.2.12.2.(2)].

Where a storage garage is located in a building containing a residential occupancy, a carbon monoxide alarm shall be installed adjacent to each sleeping area in every suite of residential occupancy that is adjacent to the storage garage [6.2.12.2.(3)].

The installation of carbon monoxide alarms is detailed in Article 6.2.12.3. Carbon monoxide alarms are required to be permanently connected to an electrical circuit with no disconnect switch, be wired so that their activation will activate all carbon monoxide alarms within the suite when located within a suite of residential occupancy, be equipped with an alarm audible within bedrooms when the intervening doors are closed, and the alarms shall conform to either CAN/CSA-6.19 or UL2034.

Masonry/Concrete Chimneys (Subsection 6.3.1.)

Masonry or concrete chimneys not more than 12 m in height when rectangular in shape, shall conform to Part 9 if they serve appliances with a combined total rated heat output of 120 kW or less, or fireplaces [6.3.1.2.(1)]. All other masonry or concrete chimneys shall be designed and installed in conformance with the requirements of NFPA 211, "Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances".

Where single wall metal smokestacks are used, they shall be designed and installed in accordance with NFPA 211 [6.3.1.3.(1)].

Access ladders for chimneys, when provided, shall consist of steel or bronze rungs built into the walls of the chimneys. Rungs for external ladders shall begin at a distance not less than 2500 mm above ground level [6.3.1.5.(1) and (2)].

14.4 PLUMBING
(Sections 7.1 and 7.6)

Plumbing Facilities

According to Sentence 7.1.4.1.(1)., plumbing facilities shall be provided in accordance with Subsection 3.7.4. and Section 9.31.

The requirements from Subsection 3.7.4. have previously been covered in Module 10 of the Large Building - 2006 course. The scope of Section 9.31 includes plumbing facilities and plumbing systems serving dwelling units, plumbing facilities, grab bars, floor drains and floor and wall finishes around urinals, for recreational camps, camps for housing workers or other buildings that are not dwelling units. Medical gas piping systems is also covered under Sentence 9.31.1.1.(3), by reference to Subsection 3.7.5.

Article 7.1.4.2. "Floor Drains", indicates:

1. Where gravity drainage is possible, a floor drain shall be installed in a basement forming part of the dwelling unit.

2. Where gravity drainage is not possible, the floor drain may be connected to a storm drainage system, dry well or drainage ditch provided it is located where it can receive only clear waste or storm sewage.

3. Floor drains shall be provided in public laundry rooms, garbage rooms, incinerator rooms, and boiler heating.

Location of Fixtures

According to Sentence 7.1.6.1.(1), plumbing fixtures are not to be installed in a room that is not lighted and ventilated in accordance with requirements of Part 9 and Part 3. Every fixture, plumbing appliance, interceptor, cleanout, valve, device or piece of equipment shall be located such that it is readily accessible for use, cleaning and maintenance [7.1.6.2.(1)].

Water Temperature Control for Potable Water Systems

The maximum temperature of water supplied by fixtures in a residential occupancy shall not exceed 49°C. This requirement does not apply to hot water supplied to dish washers or clothes washers [7.6.5.1.(1) and (2)].

The requirements for valves supplying fixed location shower heads, as well as deck mounted or hand-held spray attachments, are located in Article 7.6.5.2.

For Group B, Division 2 or 3 occupancies, or for residents of a group home, home for special care, or residences for developmentally handicapped adults, are required to have one or more temperature gauges and control devices that are:

a) accessible only to supervisory staff, and
b) capable of being adjusted to ensure that the temperature of the water supplied to the fixture does not exceed 49°C. This applies to any bath tub, shower or hand basin that is accessible to residents of these types of facilities [7.6.5.3.].

14.5 HOUSING AND SMALL BUILDINGS (PART 9 Requirements)

DESIGN OF AREAS AND SPACES (Section 9.5)

This section applies only to dwelling units that are intended for use on a continuing or year-round basis. General requirements for method of measuring areas and spaces, maximum floor areas, combination rooms and rooms with lesser dimensions than permitted in this section, are located in Subsection 9.5.1. [Part 3 reference which refers to part 9 is 3.7.1.2.(1)].

Ceiling Heights (Subsection 9.5.3.)

Minimum ceiling heights of rooms or spaces in residential occupancies, live/work units, mezzanines and storage garages are detailed in Articles 9.5.3.1., 9.5.3.2., and 9.5.3.3. [Part 3 reference which refers to part 9 is 3.7.1.1.(2)].

Living Rooms or Spaces within Dwelling Units (Subsection 9.5.4.)

According to Sentence (1) of Article 9.5.4.1., living areas within dwelling units, either separate rooms or in combination with other spaces, shall have an area not less than 13.5 m^2. Where the area of the living space is combined with a kitchen and dining area, the living area alone in the dwelling unit that can accommodate sleeping for not more than two persons, shall be not less than 11 m^2 [9.5.4.1.(2)]. [Part 3 reference which refers to part 9 is 3.7.1.2.(1)].

DOORS (Section 9.6.)

Doors to Bathrooms

According to Article 9.6.3.3., where a barrier-free path of travel conforming to Section 3.8 is provided into a suite of residential occupancy, and where the bathroom within this suite is at the level of the suite entrance door, the doorway to the bathroom and to each bedroom at the same level as the bathroom, when the door is in the open position, shall have a clear width of not less than 760 mm if the door is served by a corridor or space not less than 1060 mm wide, and 810 mm where the door is served by a corridor space less than 1060 mm wide [9.6.3.3.(1)]. [Part 3 reference which refers to part 9 is 3.8.2.1.(4)(b)(ii)].

Glass in Doors and Sidelights

Glass in doors and sidelights for doors shall conform to Sentence 9.7.3.1.(1). If the glass in the sidelight is greater than 500 mm wide, such that it could be mistaken for doors, and glass in storm doors and sliding doors at an entrance to a dwelling unit and in public areas, the safety glass of the tempered or laminated type conforming to:

a) CAN/CGSB 12.1-M, "Tempered or Laminated Safety Glass", **OR**

b) wired glass conforming to CAN/CGSB 12.11-M, "Wired Safety Glass" [9.6.6.2.(2)].

If the glass in entrance doors to dwelling units in public areas exceeds .5 m^2 and extends to less than 900 mm from the bottom of the door, the glass shall be safety glass or wired glass as previously described [9.6.6.2.(3)]. This requirement does not apply to sliding glass partitions provided they are suitably marked to indicate their position and existence [9.6.6.2.(3), 9.7.5.2.]. [Part 3 reference which refers to part 9 is 3.3.1.18.(5)].

Minimum Window Areas

Except as provided in Sentences 3.7.2.1.(2) and (3), every room used for sleeping in any building and every principle room such as a living room, dining room or combination of them in dwelling units, must be provided with windows having areas conforming to Part 9 (specifically Article 9.7.1.2.), except that Article 9.7.1.3. for bedroom windows does not apply [3.7.2.1.(1)].

Nursing homes have specific requirements for window areas, as detailed in 3.7.2.1.(2).

Play activity rooms in a child care facility and work areas in live/work units shall have one or more windows that conform to Clause 3.7.2.1.(2)(a).

The requirements in Table 9.7.1.2 that is referenced for minimal window glass areas vary depending upon whether or not electrical lighting is provided in the room and the location of the room.

STAIRS, RAMPS, HANDRAILS AND GUARDS (Section 9.8.)

This section applies to the design and construction of interior and exterior stairs, steps, ramps, railings and guards.

Section 9.8 is broken down into the following Subsections: 9.8.1., Application, 9.8.2., Stair Dimensions, 9.8.3., Stair Configurations, 9.8.4., Step Dimensions, 9.8.5., Ramps, 9.8.6., Landings, 9.8.7., Handrails, 9.8.8., Guards. 9.8.9., Construction, and 9.8.10., Cantilevered Pre-cast Concrete Steps. [Part 3 reference which refers to part 9 is 3.3.4.7.(1)].

The Subsection 9.8.9., Construction, includes Articles describing loads on stairs and ramps, construction requirements for exterior concrete stairs, exterior wood stairs, wooden stair stringers, treads and finishes for treads, landings and ramps.

Lighting Outlets (Subsection 9.34.2.)

This Subsection covers requirements for lighting of entrances and the provision of exterior lighting outlets, light outlets in dwelling units, lighting of stairways, basement lighting, lighting for storage rooms, garages and car ports, and lighting outlets for public or service areas in buildings, including recreational camps and camps for housing workers. [Part 3 reference which refers to part 9 is 3.2.7.1.(3)].

Article 9.34.2.7. includes a Table with prescriptive lighting requirements for public areas which defines the minimum illumination levels in lux, and the minimum lighting power density per floor area measured in Watts per metre squared for incandescent lighting. [Part 3 reference which refers to part 9 is 3.2.7.1.(2)].

14.6 RESOURCE CONSERVATION (Part 12)

The requirements of Part 12 apply to all buildings. This Part applies to resource conservation in the design and construction of buildings.

Energy Efficiency Design (Subsection 12.2.1.)

Energy Efficiency Design Before January 1, 2012

The following requirements apply to construction for which a permit has been applied for before January 1, 2012. The energy efficiency of all buildings shall be designed to good engineering practices described in:

a) The ANSI/ASHRAE/IESNA 90.1, “Energy Standard for Buildings Except Low-rise Residential Buildings”, and

Supplementary Standard SB-10, **OR**

b) The CCBFC, "Model National Energy Code for Buildings" and Supplementary Standard SB-10 [12.2.1.1.(2)].

Energy efficiency design does not apply to farm buildings and buildings intended primarily for manufacturing or commercial or industrial processing [12.2.1.1.(5)].

Energy Efficiency Design After December 31, 2011

After December 31, 2011, the energy efficiency of all buildings shall be designed to exceed by not less than 25% the energy efficiency levels attained by conforming to the CCBFC, "Model National Energy Code for Buildings".

These requirements do not apply to farm buildings and buildings intended primarily for manufacturing or commercial or industrial processing [12.2.1.2.(5)].

Motion Sensors (Subsection 12.2.2.)

The requirements for motion sensors are found in Article 12.2.2.1. According to Sentence (1), lighting installed to provide the minimum illumination levels required by the Code may be controlled by motion sensors except for the following locations where lighting is:

a) installed in an exit,
b) installed in a corridor serving patients or residents in a Group B, Division 2 or 3 occupancy, **OR**
c) required to conform to Sentence 3.2.7.1.(5).

Sentence (2) indicates, where motion sensors are used to control minimum lighting in a public corridor, or corridor providing access to exit for the public, a motion sensor shall be installed with switch controllers equipped for fail-safe operation and illumination timers for a minimum 15 minute duration.

Sentence (3) indicates, a motion sensor shall not be used to control emergency lighting.

WATER EFFICIENCY (Section 12.4.)

According to Sentence 12.4.1.1.(1), all buildings must conform to the water efficiency requirements of Subsection 7.6.4.

Subsection 7.6.4. describes water efficiency ratings and maximum flow rates and pressures in flow rates and test pressures for fittings such as lavatory faucets, kitchen faucets and shower heads. Article 7.6.4.2. provides maximum flush cycles for sanitary fixtures.

Supplementary Standard SB-10

Supplementary Standard SB-10 is the energy efficiency supplement and it forms a part of the requirements contained in Part 12, Resource Conservation.

SB-10 includes three chapters, Chapter 1, General; Chapter 2, Supplement to ANSI/ASHRAE/IESNA Standard 90.1 and Chapter 3, Supplement to MNECB (Model National Energy Code for Buildings, 1997).

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Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MODULE 15

COMPLEX BUILDINGS - 2006

SAMPLE EXAM QUESTIONS

QUESTIONS

1. According to Part 3 of the Building Code, what is the maximum permitted smoke developed classification of the ceiling finish of a corridor (not within suites) in a building regulated by the provisions of Subsection 3.2.6.?

a) 500
b) 50
c) 100
d) 300

2. What minimum row spacing is required in a theatre that has two aisles with 36 fixed seats between the aisles.

a) 400 mm
b) 497.6 mm
c) 522 mm
d) 619.6 mm

3. According to Section 3.7 of the Building Code, a camp for housing workers shall have an area of not less than;

a) 3.72 m^2 per employee in every room used for sleeping
b) 16.72 m^2 per employee in every room used for sleeping
c) 2.79 m^2 per employee
d) 29.73 m^2 per unit

4. A bank of five wall-hung public telephones is provided in a mall entrance vestibule. Telephones are provided with counters at varying heights. What is the maximum height of the telephone receiver measured from the top of the counter that is required to be barrier-free accessible?

a) 515 mm
b) 350 mm
c) 250 mm
d) 335 mm

5. What component of a fire alarm system, required by Subsection 3.2.4., "Fire Alarm and Detection Systems", is not required in a rapid transit station?

a) Central supervising station
b) Voice communication messages
c) Manual pull stations
d) Fire detectors

6. A building has columns located partly outside of the exterior face of a building. When does the code require the structural members to be protected?

a) Located 3 m from the property line
b) Located 2 m from the property line
c) Located 3.2 m from the property line
d) Heavy timber membranes located 3 m from the property line

7. Consider a public pool where 50% of the pool is deeper than 1350 mm and the pool water surface area measures 10 m x 35 m. According to Article 3.1.17.3 the occupant load of the pool is:

a) 195
b) 458
c) 790
d) 229

8. Which one of the following major occupancies is exempt from being considered a major occupancy per Article 3.2.2.8.?

a) A Group F, Division 1 major occupancy comprising 9% of the floor area of the storey in which it is located
b) A helicopter pad comprising an area equivalent to 11% of the area of the roof on which it is located
c) A Group D major occupancy comprising an aggregate area equivalent to 10.5% of the floor area of the storey in which it is located
d) A Group E major occupancy having an aggregate area of 8% of the floor area of the storey in which it is located

9. According to Subsection 3.2.4, the type of fire alarm system required in:

   a) All Group B occupancies is a 2 stage system
   b) All Group B occupancies can either be with a single stage or 2 stage system
   c) All Group B occupancies in buildings more than 3 storeys in building height is a 2 stage system
   d) A secondary school is a 2 stage system

10. According to Section 3.10 of the Building Code, single storey sprinklered self-storage buildings are required to be provided with hydrants located;

    a) Adjacent to at least 50% of the building perimeter
    b) A fire department pumper vehicle can be located adjacent to the hydrant within 45 m of the fire department connection
    c) Around the building to provide firefighters an unobstructed path of travel of not more than 90 m to the main entrance
    d) Within 45 m of the main entrance

11. A tent need not conform to Article 3.4.6.11. when the tent:

    a) exceeds an area of 225 m^2
    b) has an occupant load of more than 60 persons
    c) is provided with swing type doors
    d) is provided with flap type doors

12. Consider a sprinklered building that is subject to the requirements of Section 3.2.6. Which elevator recall requirement applies?

    a) Automatic emergency recall is required for all elevators serving storeys above the first storey
    b) Manual emergency recall is required for all elevators serving storeys above the first storey
    c) Automatic emergency recall is required for all elevators serving all storeys
    d) Manual emergency recall is required for all elevators serving all storeys

13. A sprinklered building having a Group F, Division 1 occupancy, has an exterior building face with 24.5% allowable unprotected openings. What is the construction requirement for the exposing building face?

    a) 45 min fire resistance rating and clad with noncombustible cladding
    b) 45 min fire resistance rating
    c) 1h minimum fire resistance rating and clad with noncombustible cladding
    d) 2 h fire resistance rating and clad with noncombustible cladding

14. What is a Part 11 compliance alternative for the requirement in Sentence 3.6.2.1.(7) for service rooms in an assembly occupancy to be separated from the remainder of the building by a fire separation having a fire-resistance rating not less than 1 h, in an assembly occupancy?

    a) Existing fire separation is acceptable
    b) Existing fire separation with a fire-resistance rating of at least 30 min is acceptable
    c) No fire separation is required
    d) There is no compliance alternative

15. According to Article 3.3.1.4., if a storey is sprinklered, no fire resistance rating is required for fire separations between a public corridor and the remainder of the storey provided the public corridor:

    a) is not more than 9 m in unobstructed width
    b) serves a residential occupancy
    c) does not serve a care or detention occupancy
    d) is more than 3 m in unobstructed width

16. According to Sentence 3.4.2.1.(2), a sprinklered floor area in a 2 storey office building, with an occupant load of 25, and the maximum travel distance to the exit is 25m, is permitted to be serviced by one exit if the maximum floor area is:

    a) 200 m^2
    b) 300 m^2
    c) 100 m^2
    d) 150 m^2

17. According to Subsection 3.12., where a set of steps is provided for entry into and egress from a public spa, the step must be equipped with:

a) Handrails on both sides
b) A handrail with a height of not less than 900 mm
c) A guard
d) A handrail

18. A vapour barrier is not required where it can be shown that uncontrolled vapour diffusion will not adversely affect:

a) The fire-resistance rating of the exterior wall
b) The flame spread rating of the interior wall finishes
c) The health or safety of the building users
d) The thermal barrier system

19. In accordance with SB-2, what is the fire-resistance rating of a ceiling membrane comprised of double 15.9 mm Type X gypsum wallboard?

a) 30 min
b) 90 min
c) 45 min
d) 60 min

20. According to Section 3.7 of the Building Code, play activity rooms in a child care facility shall have:

a) Windows that open to the exterior
b) One or more windows with a total unobstructed glass area of not less than 20% of a the area of the room
c) A skylight
d) One or more windows with a total unobstructed glass area of not less than 10% of the area of the room

21. An elevator hoistway shall be separated from all other portions of each adjacent storey by a fire separation having a fire-resistance rating conforming to Table 3.5.3.1 for:

a) The floor assembly above the storey
b) The wall assembly above the storey
c) The root assembly
d) The exit stair shaft

22. In accordance with Article 3.13.3.5, what is the required fire-resistance rating of a fire separation located between a rapid transit station and an adjoining vehicle terminal serving vehicles powered by combustible fuels?

a) 45 min
b) 1-1/2 h
c) 1 h
d) 2 h

23. A sign structure is required to be designed in accordance with Part 4 of the Code, except when the sign:

a) weighs less than 110 kg
b) is painted on the face of a building
c) is 7.6 m in height above finished grade
d) has an area more than 10 m^2

24. Which of the following provisions for fire fighting in Subsection 3.2.5 is not a correct statement:

a) Each building exterior wall that is required to face a street is required to be provided with outside access for fire fighting by access panels or windows for above grade storeys up to 25 m above grade
b) Direct access is required from the outside for basements with a horizontal dimension more than 25
c) Main building roof areas, with a slope of less than 1 in 4, are required to be provided access from the floor areas below the roof
d) Fire department access routes are required for buildings that do not exceed: 3 storeys in building height, or 600 sq. m in building area

25. A proposed office building will feature a 5-storey atrium. Which fire alarm system requirement applies? All floor areas within the interconnected floor space are classified as Group D occupancy.

    a) Smoke detectors must be provided on the ceiling in the vicinity of the atrium floor opening on each storey
    b) Smoke detectors, or heat detectors, must be provided on the ceiling in the vicinity of the atrium floor opening on each storey
    c) Fire detection is not required on the ceiling in the vicinity of the atrium floor opening on each storey since the building will be fully sprinklered
    d) Fire detection is not required on the ceiling in the vicinity of the atrium floor opening on each storey provided that the sprinkler system is provided with facilities to transmit a signal to the fire department

26. What are the assigned flame spread ratings and smoke developed classifications for 11 mm thick, unfinished, Douglas fir plywood without a cellulose resin overlay, manufactured in accordance with the standard CSA O121?

    a) 25/50
    b) 150/300
    c) 0/0
    d) 150/100

27. The following is not considered an exit:

    a) A fire escape conforming to Subsection 3.4.7
    b) An exterior passageway
    c) An interior stairway
    d) A service ladder in a shaft used as a plenum for a heating, ventilating or air-conditioning system

28. According to the tables used for compliance alternatives, in a hospital, existing functionally operable latching devices, excluding draw bolts, are acceptable as a compliance alternative to the following Part 3 requirement:

    a) Article 3.1.8.13.
    b) Article 3.1.8.14.
    c) Article 3.1.8.15.
    d) Article 3.1.8.16.

29. What is the minimum dimension of a special barrier-free washroom?

    a) 1500 mm
    b) 1700 mm
    c) 1400 mm
    d) 1020 mm

30. What is the occupant load of an office occupying 100 m^2 of floor area of an office building?

    a) 11 persons
    b) 22 persons
    c) 100 persons
    d) 2 persons

ANSWERS

1.	b)	[3.1.13.7.(1)]
2.	c)	[3.3.2.3.(5)(c)]
3.	a)	[3.7.1.4.(2)]
4.	d)	[3.8.3.15.(2) and (3)]
5.	c)	[3.13.5.2.(1)]
6.	a)	[3.2.3.9.(1)]
7.	a)	[3.1.17.3.(1)]
8.	d)	[3.2.2.8.(1)]
9.	c)	[3.2.4.3.(1)(b)]
10.	b)	[3.10.4.5.(3), 3.10.3.4.(3)(a)]
11.	d)	[3.14.1.3.(1)]
12.	b)	[3.2.6.8.(1)]
13.	d)	[3.2.3.7.(5)]
14.	b)	[compliance alternative A 54]
15.	c)	[3.3.1.4.(3)]
16.	b)	[3.4.2.1.(2)(b)]
17.	d)	[3.12.2.1.(7)(a)]
18.	c)	[5.5.1.1.(3)(a)]
19.	d)	[SB-2 - 2.3.12.]
20.	d)	[3.7.2.1.(3)]

21.	a)	[3.5.3.1.(1)]
22.	c)	[3.13.3.5.(1)(b)]
23.	b)	[3.15.3.1.(1), 3.15.1.2.(1)(d)]
24.	d)	[3.2.5.1., 3.2.5.2., 3.2.5.3., 3.2.5.4.]
25.	b)	[3.2.8.8.(1)]
26.	d)	[SB-2, Table 3.1.1.A]
27.	d)	[3.4.1.4.(1)]
28.	a)	[3.1.8.13.(1), CA-B11]
29.	b)	[3.8.3.12.(1)(f)]
30.	a)	[Table 3.1.17.1]

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Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT MANUAL

APPENDIX A

COMPLEX BUILDINGS - 2006

ADDITIONAL STUDY MATERIALS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

A.1 INTRODUCTION

As indicated in Module 1, the 2006 edition of the Building Code has been reformatted and is now written in an objective-based format.

The following examples provide an illustration of how "Alternative Solution" approaches [Div A, Part 1, Sentence 1.2.1.1.(1)(b)] may be presented together with guidance on how to find the applicable objective and functional statements in Supplementary Standard SA-1.

Example of Alternative Solution Approach

If a designer wished to utilize the "Alternative Solution" approach to the requirements in Division B, Sentence 3.3.1.4.(1), according to Sentence 1.2.1.1.(1)(b), [Division A, Part 1], one means of demonstrating compliance with the prescriptive "*acceptable solutions*" in Division B of the Code, is to use an "*alternative solution*" that will achieve the level of performance required by the applicable *acceptable solution* in Division B, Sentence 3.3.1.4.(1) in respect of the *objectives* and *functional statements* attributed to the applicable *acceptable solution* in Supplementary Standard SA-1. For the purpose of 1.2.1.1.(1)(b), the level of performance in respect to a *functional statement* refers to the performance of the *functional statement* as it relates to the *objective* to which it is associated in Supplementary Standard SA-1. This is the principle behind the new "Objective-Based Code".

In Division C, Part 2, Article 2.1.1 "Documentation of Alternative Solutions" describes the documentation that must be provided to the Chief Building Official to demonstrate that the proposed *alternative solution* will achieve the level of performance required under Article 1.2.1.1. of Division A of the Code. This documentation includes a rationale to compare the performance of the proposed "alternative solution" design with a design that is known to be acceptable.

1. For Sentence 3.3.1.4.(1), the applicable objective and functional statements are shown in Table 1.

2. The designer wishes to submit an "alternative solution" as follows (refer to Figure A-1).

3. In lieu of providing a fire separation that is continuous from the ground floor to the underside of the second floor between a public corridor and the remainder of the storey in a two-storey sprinklered office building (Group D), the designer proposes to use a fire separation that is not continuous vertically to the underside of the second floor, but one that terminates at a ceiling that by utilizing sealants provides a continuous separation between the public corridor and the remainder of the storey.

In the submission, the designer would need to demonstrate that the fire and smoke barrier properties of the proposed separation is at least equivalent to that of a continuous floor-to-floor vertical fire separation on each side of the public corridor. Test information such as that found in Supplementary Standard SB-2 Fire Performance Ratings, or in the ULC fire-resistance directory could be used to show that the membrane used provides a fire separation both when installed vertically and horizontally.

Such a submission may demonstrate that the objectives and functional statements in Table 1 have been satisfied by the "alternative solution".

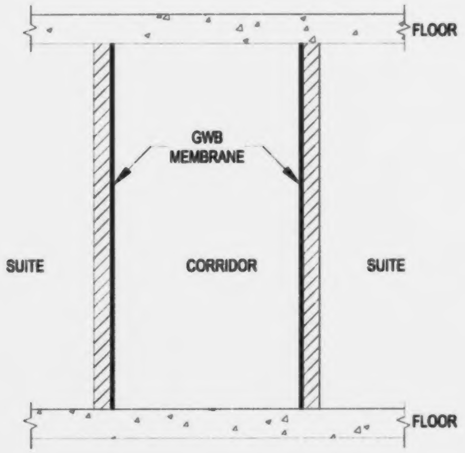
STOP

TABLE 1

Objective Statements	Functional Statements
OP1 - Fire, Structural, Water and Sewage Protection of Buildings – Fire Protection of the Building	
OP1.2 – An objective of this Code is to limit the probability that as a result of its design or construction, a building will be exposed to an unacceptable risk of damage due to fire, caused by fire or explosion impacting areas beyond its point of origin.	**F03** – To retard the effects of fire on areas beyond its point of origin. **F06** – To retard the effects of fire on facilities for notification, suppression and emergency
OS1 – Safety – Fire Safety	
OS1.2 – An objective of this Code is to limit the probability that as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by fire or explosion impacting areas beyond its point of origin.	**F06** – To retard the effects of fire on facilities for notification, suppression and emergency
OS1.5 - An objective of this Code is to limit the probability that as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by persons being delayed in or impeded from moving to a safe place during a fire emergency.	**F03** – To retard the effects of fire on areas beyond its point of origin. **F05** – To retard the effects of fire on emergency egress facilities **F06** – To retard the effects of fire on facilities for notification, suppression and emergency

Fire Separation of Public Corridor from Remainder of the Storey 3.3.1.4.(1)

ACCEPTABLE SOLUTION


FLOOR
GWB MEMBRANE
SUITE
CORRIDOR
SUITE
FLOOR

ALTERNATIVE SOLUTION - Proposed

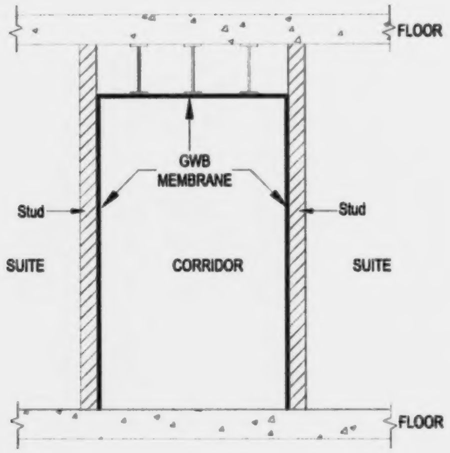

FLOOR
GWB MEMBRANE
Stud
Stud
SUITE
CORRIDOR
SUITE
FLOOR

FIGURE A-1

Ontario

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COMPLEX BUILDINGS

QUESTIONS AND ANSWERS

EXERCISE #1-1

1. Provide the objectives and functional statements attributed to the following (acronyms only required):

   a) 3.3.1.20.(1) ______________ [______________]

   b) 3.8.3.3.(3) ______________ [______________]

   c) 4.1.5.15.(3) ______________ [______________]

   d) 6.3.1.2.(2) ______________ [______________]

   Answers

   a) F03- OP1.2, F03-OS1.2 [SA-1, TABLE 3]

   b) F10- OS3.7, F74-OA2 [SA-1, TABLE 3]

   c) None provided [SA-1, TABLE 4]

   d) F01- OP1.1, F01- OS1.1[SA-1, TABLE 6]

2. What is objective OS1.3? What category?

   ______________________ [______________]

   Answer

   An objective of this Code is to limit the probability that as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by the collapse of physical elements due to a fire or explosion. Category – Fire Safety [Div. A, Table 2.2.1.1]

3. What is functional statement F12?

   ______________________ [______________]

   Answer

   To facilitate emergency response [Div. A, Table 3.2.1.1]

EXERCISE #2-1

Examine Figure 2-1. Take about 10 minutes to determine the minimum fire-resistance rating for the fire separations between the adjoining major occupancies based on Subsection 3.1.3. only. Write your answers on the Drawings. Are your determinations the same as those of the rest of the group?

You will observe that some combinations do not represent a hazard to each other. Consequently, the Table does not call for a fire separation. It is also important to note that a number of major occupancies are prohibited from being in the same building because of the perceived threat from one to another (i.e. see Article 3.1.3.2.). For this exercise, we are not concerned with other types of fire separations. Have group discussions as required. Class discussions will begin in about 10 minutes.

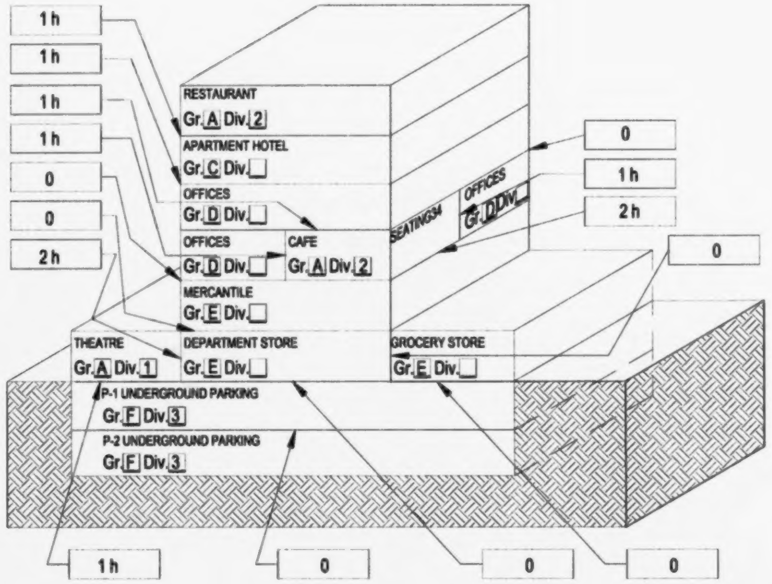
Notes ____

____

____

____

Minimum Fire-Resistance Rating of Fire Separations Between Adjoining Major Occupancies


1 h
1 h
1 h
1 h
0
0
2 h
RESTAURANT
Gr. A Div. 2
APARTMENT HOTEL
Gr. C Div.
OFFICES
Gr. D Div.
OFFICES
Gr. D Div.
CAFE
Gr. A Div. 2
MERCANTILE
Gr. E Div.
SEATING34
OFFICES
Gr. D Div.
0
1 h
2 h
0
THEATRE
Gr. A Div. 1
DEPARTMENT STORE
Gr. E Div.
GROCERY STORE
Gr. E Div.
P-1 UNDERGROUND PARKING
Gr. F Div. 3
P-2 UNDERGROUND PARKING
Gr. F Div. 3
1 h
0
0
0

Schematic of uses for a multi-storey building not regulated by Subsection 3.2.6.
Indicate fire-resistance ratings (in hours) beside arrows.

FIGURE 2-1

EXERCISE #2-2

1. In an unsprinklered building regulated by 3.2.6., combustible insulation with a flame-spread rating of less than 500 is permitted within ceilings provided it is protected by a thermal barrier consisting of the following:

   a) 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation.

   b) Any thermal barrier that meets the requirements of classification B when tested in conformance with CAN4-S124-M.

   c) 15.9 mm thick Type X gypsum board mechanically fastened to a supporting assembly independent of the insulation with all joints either backed or taped and filled.

   d) Sheet steel not less than 0.38 mm thick which will remain in place for not less than 10 minutes when tested in conformance with CAN/ULC-S101-M.

   c) *[3.1.5.12.(4)(a)]*

2. What is the maximum permitted flame-spread rating for 5 mm thick combustible interior wall finishes (not foamed plastic) used in a building required to be of noncombustible construction?

   a) 25
   b) 50
   c) 150
   d) 500

   c) *[3.1.5.10.(2)(b)]*

EXERCISE #2-3

1. According to 3.1.8.15., the maximum temperature rise on the opaque portion of a 3 h fire door installed in a firewall with a required 4 h fire-resistance rating is:

   a) 250°C after 30 min
   b) 250°C after 1 h
   c) 250°C after 3 h
   d) No limit

______________________________[________________]

b) [Table 3.1.8.15.]

2. If the fire compartments on both sides of an interior fire separation are not sprinklered, what is the maximum size of opening that can be protected with a closure?

   a) 22 m^2 with no dimension more than 6 m

   b) 100 m^2 with no dimension more than 10 m

   c) No limit

   d) 11 m^2 with no dimension more than 3.7 m

______________________________[________________]

d) [3.1.8.6.(1)]

EXERCISE #2-4

1. What Standard test is required to be used to test for determining the flame-spread rating of a thermoplastic foamed plastic insulation?

   a) CAN/ULC-S102.2

   b) CAN/ULC-S102

   c) ULC-S102.3

   d) CAN/ULC-S101

______________________________[________________]

a) [3.1.12.1.(2)(c)] thermoplastic

2. What is the maximum permitted frame spread rating for the interior wall finish of a corridor serving classrooms in an unsprinklered high school?

   a) 25

   b) 75

   c) 150

   d) 300

______________________________[________________]

b) [3.1.13.6.(1)(c)]

3. According to Article 3.1.13.2. the maximum permitted flame-spread rating for doors installed within a dwelling unit is?

   a) 150

   b) No limit

   c) 200

   d) 25

______________________________[________________]

b) [3.1.13.2.(3)]

EXERCISE #2-5

1. According to Article 3.1.13.7. in an unsprinklered building regulated by 3.2.6., the maximum frame-spread rating, X and smoke developed classification, Y for the floor surface of an elevator car is expressed (X/Y):

   a) 25/50

   b) 25/100

   c) 25/300

   d) 300/300

______________________________[________________]

d) [Table 3.1.13.7.]

2. The maximum permitted flame-spread rating and smoke developed classification for trim covering 11% of the wall surface area of a public corridor (not within a suite) in an unsprinklered building regulated under 3.2.6. is:

   a) 150/300

b) 75/no limit

c) (25 for upper half of wall, 150 on lower half)/no limit

d) 75/100

______________________________ [______________]

d) *[3.1.13.6.(1)(a) and Table 3.1.13.7.]*

EXERCISE #3-1

1. For the masonry unit (concrete block) shown in Figure 3-1, calculate the equivalent thickness. Give SB-2 Sentence(s) used.

____

____

____

____

______________________________ [______________]

Volume of voids $= 120 \times 150 \times 200 \times (2)$
$= 7{,}200{,}000\ mm^3$

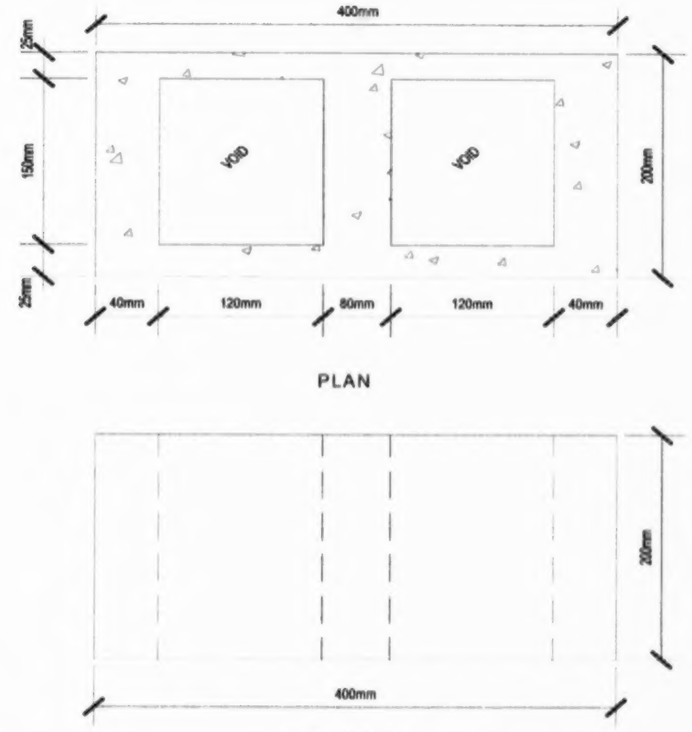
Gross volume of block $= 400 \times 200 \times 200$
$= 16{,}000{,}000\ mm^3$

Net volume $= 16{,}000{,}000 - 7{,}200{,}000$
$= 8{,}800{,}000\ mm^3$

Equivalent thickness $= 200\ mm\ thick \times \frac{8.8}{16}$
$= 110\ mm$

Answer: *110 mm [1.6.1.(3), (4), (5)]*

Masonry Unit


400mm
25mm
150mm
25mm
200mm
VOID
VOID
40mm
120mm
80mm
120mm
40mm
PLAN
200mm
400mm
ELEVATION

Note:

Use actual dimensions, not nominial dimensions.

FIGURE 3-1

EXERCISE #3-2

1. Calculate the fire-resistance rating for the non-loadbearing wall assembly shown on the attached Figure 3-2. Give SB-2 references for your answer.

- *Contribution of 15.9 mm Type X gypsum board:*
  40 min [Table 2.3.4.A]
- *Contribution of steel studs at 300 mm oc*
  10 min [Table 2.3.4.C]
- *Contribution of rock fibre insulation*
  0 [Table 2.3.4.D]
  (Only contribution if wood studs used)

Total rating: 50 min

Fire-Resistance Rating, Interior Vertical Fire Separation

FUGURE 3-2: COMPLEX BUILDINGS

Figure 3-2

Fire-Resistance Rating, Interior Vertical Fire Separation
(non loadbearing)

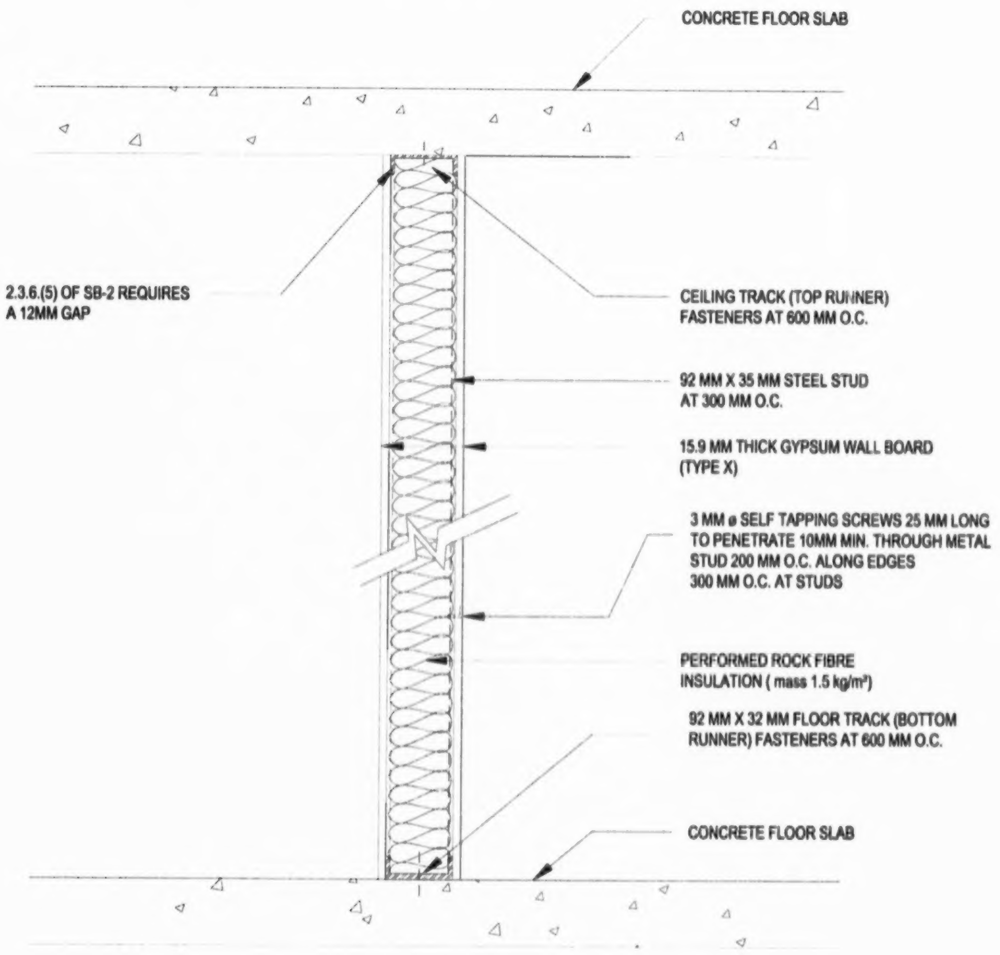

CONCRETE FLOOR SLAB
2.3.6.(5) OF SB-2 REQUIRES A 12MM GAP
CEILING TRACK (TOP RUNNER) FASTENERS AT 600 MM O.C.
92 MM X 35 MM STEEL STUD AT 300 MM O.C.
15.9 MM THICK GYPSUM WALL BOARD (TYPE X)
3 MM ø SELF TAPPING SCREWS 25 MM LONG TO PENETRATE 10MM MIN. THROUGH METAL STUD 200 MM O.C. ALONG EDGES 300 MM O.C. AT STUDS
PERFORMED ROCK FIBRE INSULATION (mass 1.5 kg/m^3)
92 MM X 32 MM FLOOR TRACK (BOTTOM RUNNER) FASTENERS AT 600 MM O.C.
CONCRETE FLOOR SLAB

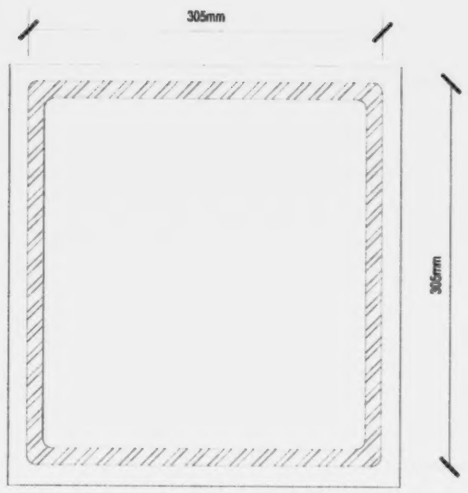
FIGURE 3-2

EXERCISE #3-3

1. Calculate the mass/heated perimeter (M/D) ratio for the steel column shown in Figure 3-3 and determine its maximum fire-resistance rating, if it is protected with 38.1 mm of gypsum wallboard, and installed in accordance with 2.6.5. The mass of the column is 113 kg/m.

   Give SB-2 references with your answers.

Steel Column



Answer:

$M = 113$ kg/m

$D = 2(B + H)$

$= 2(.305 + .305)$

$= 1.22$ m

$$M/D = \frac{113}{1.22}\ \frac{\text{kg/m}}{\text{m}} = 92.6\ \text{(kg/m)/m}$$

Maximum FRR = 2 h [Table 2.6.1.F]

FIGURE 3-3

EXERCISE #3-4

1. What is the flame spread rating of 12.7 mm thick unfinished poplar plywood (without cellulose resin overlay)? Give material Standard in your answer.

____________________ [____________]

150 (CSA 0153-M)

2. What is the smoke developed classification of woven wool carpet, with a pile weight of 1500 g/m^2, applied without felt underlay? Give material Standard, including date, in your answer.

____________________ [____________]

300 (CAN/CGSB-4.129)

EXERCISE #4-1

1. Select the correct condition under which visual obstructions above 1,070 mm in height are permitted on a 40% (open) mezzanine.

   a) 40% (open) mezzanine, Group D office occupancy with filing cabinets at 1,080 mm above the mezzanine floor.

   b) 40% (open) mezzanine, Group A, Division 1 occupancy with viewing screen at 2,100 mm in height above the mezzanine floor.

   c) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,000 mm above the mezzanine floor and 80% of the floor-to-ceiling height of the space above the floor assembly.

   d) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,100 mm above the floor of the mezzanine and 70% of the floor-to-ceiling height of the space above the mezzanine floor assembly.

____

____

____

____

____________________ [____________]

d) Obstructions exceeding 1070 mm in height above the mezzanine floor are permitted in libraries. However, the requirements of Sentence 3.3.2.11.(3) must be met. Specifically, the height of the shelves must not exceed 2100 mm and not exceed more than 75% of the floor-to-ceiling height of the space above or below the mezzanine floor assembly [Clause 3.2.1.1.(3)(b), Sentence 3.3.2.11.(3)].

2. Review Figure 4-7. Does the proposed configuration of proposed mezzanines satisfy the exemption for storeys? Provide support, with Code references, for your answer.

____

____

____

____________________ [____________]

Configuration of the mezzanines does not meet the requirements for exemption as a storey per Sentence 3.2.1.1.(4) and Sentence 3.2.1.1.(5). Although the aggregate area of the mezzanines is less than 10% of the ground floor storey in which it is located, one of the mezzanines is partially superimposed above another. Therefore, the mezzanine level above the first mezzanine must be considered as a storey [Sentence 3.2.1.1.(4), Sentence 3.2.1.1.(5)].

3. In a building of Group C (residential) major occupancy, a laundry room for the use of building occupants is located within the rooftop enclosure. The laundry room comprises 15% of the area of the rooftop enclosure. Must the rooftop enclosure be considered as a storey? Select the most correct answer from the options below.

   a) No, this rooftop occupancy is not required to be considered as a storey.

   b) Yes, the rooftop laundry room must be considered as a storey because it comprises more than 10% of the area of the roof on which it is located.

   c) Yes, the rooftop laundry room must be considered as a storey as it is not a service room.

   d) No, this rooftop enclosure is not required to be considered as a storey because it is only for building occupants.

____

____

____

____

_________________________ [____________]

c) Yes, the rooftop enclosure containing the laundry room must be considered as a storey as it is [Sentence 3.2.1.1.(1), Article 1.4.1.2. "Service Room"], [Appendix A-1.4.1.2. "Service Room"]

4. Review Figure 4-8. Which, if any, of the mezzanines must be considered as storeys? If they are indeed storeys, how many additional storeys do the mezzanines contribute?

____

____

____

____

_________________________ [____________]

The mezzanines are visually "open" (i.e. no visual obstructions over 1070 mm). The aggregate area of the mezzanines is less than 40% but more than 10%. Although the two lower mezzanines are at differing heights from the floor level, they are at opposite sides of the room (i.e. not superimposed). The superimposed mezzanine (A) must be considered a storey. This adds one additional storey to the building height [Sentence 3.2.1.1.(3), Sentence 3.2.1.1.(4) and Sentence 3.2.1.1.(5)].

EXERCISE #4-2

Using the preceding information in combination with reference to the Building Code, as applicable, answer the following questions.

1. Consider the building shown in Figure 4-12 and determine the most appropriate construction classification Article.

a) Article 3.2.2.56., Group D, up to 2 Storeys, Sprinklered

b) Article 3.2.2.57., Group E, Any Height, Any Area, Sprinklered

c) Article 3.2.2.60., Group E, up to 3 Storeys, Sprinklered

d) Article 3.2.2.61., Group E, up to 2 Storeys

_________________________ [____________]

c) Article 3.2.2.60. Group E, up to 3 Storeys, Sprinklered

2A. Consider Figure 4-13. Identify the most appropriate classification of building based on construction classification Article(s) applicable to the major occupancies in the building.

a) Article 3.2.2.65. - Group F, Division 1 up to 2 Storeys, Sprinklered
b) Article 3.2.2.72. - Group F, Division 2 up to 2 Storeys, Sprinklered
c) Article 3.2.2.56. Group D up to 2 Storeys, Sprinklered

2B. What requirement would you apply?

The most restrictive [3.2.2.6.]

3. Based on Subsection 3.2.2., identify the most appropriate construction classification Article(s) applicable to Figure 4-14. What fire-resistance rating is required between the major occupancies?

____

____

____

____

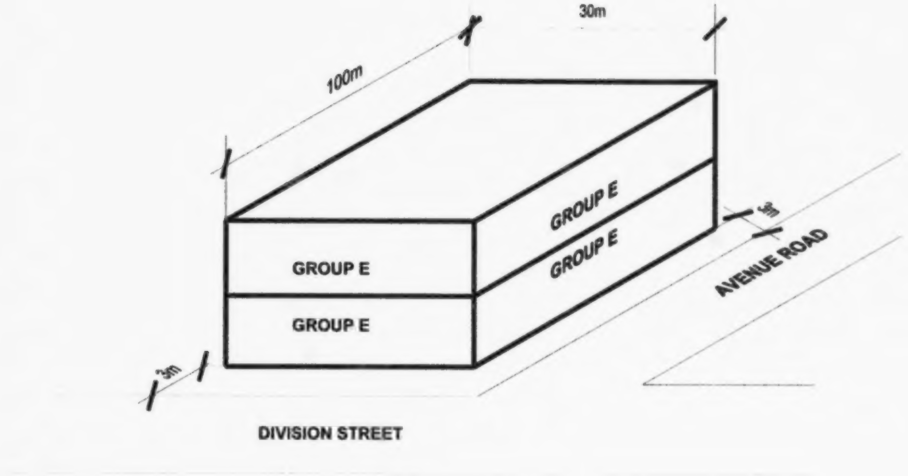
____

_________________________ [____________]

a) Article 3.2.2.20. Group A, Division 1, Any Height, Any Area, Sprinklered
b) Article 3.2.2.23. Group A, Division 2, Any Height, Any Area, Sprinklered
c) Article 3.2.2.42. Group C, Any Height, Any Area, Sprinklered
d) Article 3.2.2.49. Group D, Any Height, Any Area

e) Article 3.2.2.57. Group E, Any Height, Any Area, Sprinklered

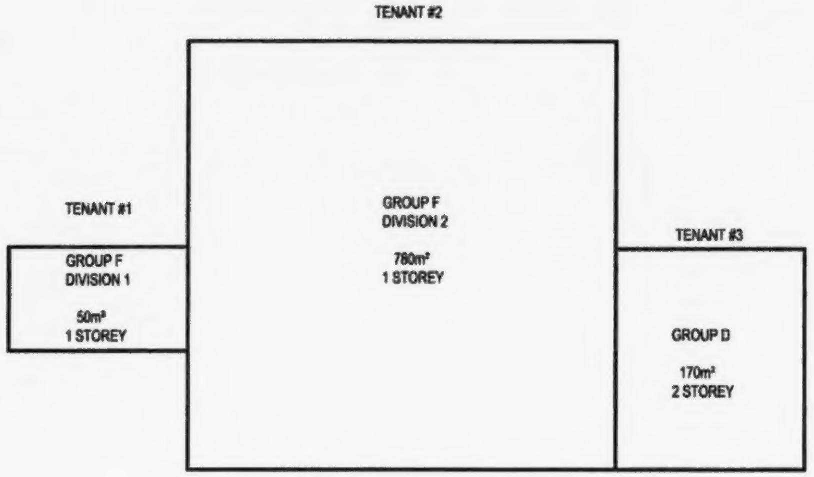
All major occupancies must be separated by floor assemblies having a fire-resistance rating of 2 h.


30m
100m
GROUP E
GROUP E
GROUP E
GROUP E
3m
AVENUE ROAD
3m
DIVISION STREET

Note:

1. The building is provided with sprinkler protection throughout.

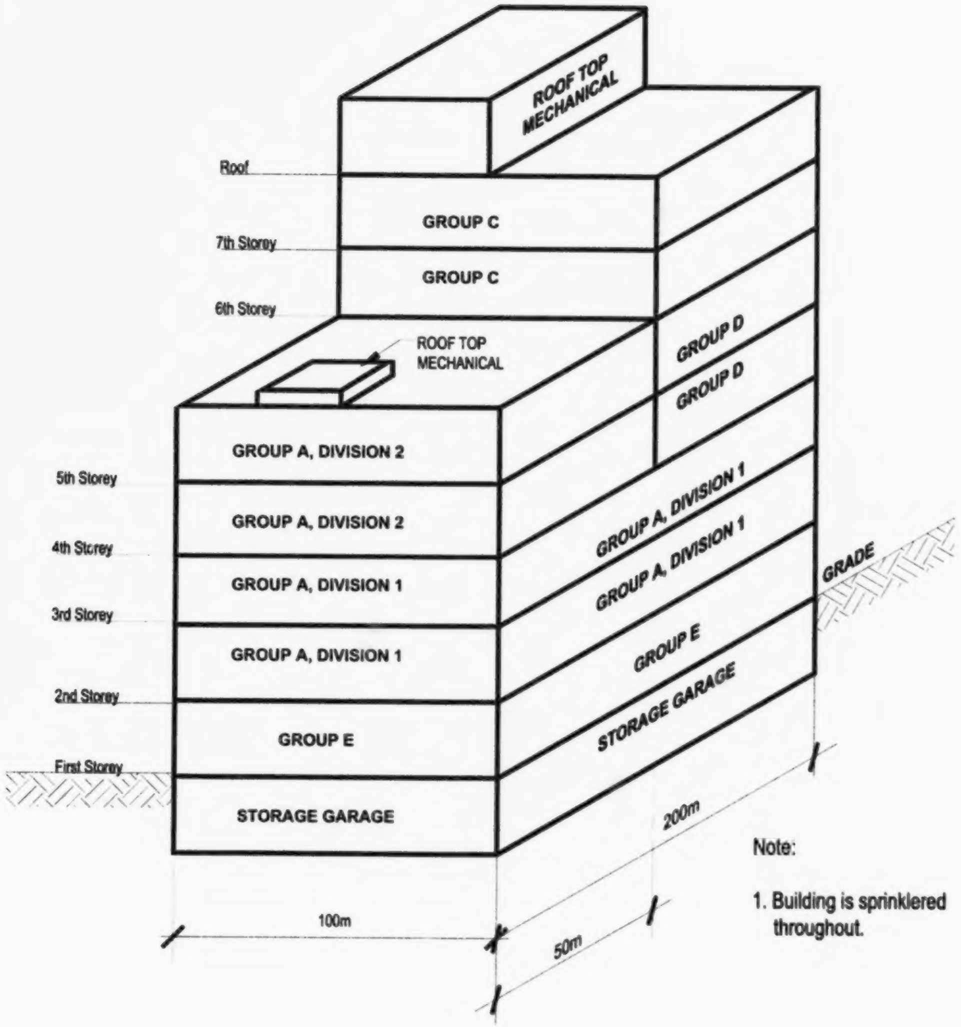
FIGURE 4-12


TENANT #2
TENANT #1
GROUP F
DIVISION 2
780m²
1 STOREY
TENANT #3
GROUP F
DIVISION 1
50m²
1 STOREY
GROUP D
170m²
2 STOREY

Note:

1. Building is sprinklered throughout.
2. Separations between major occupancies are not firewalls.

FIGURE 4-13


ROOF TOP
MECHANICAL
Roof
GROUP C
7th Storey
GROUP C
6th Storey
ROOF TOP
MECHANICAL
GROUP D
GROUP D
GROUP A, DIVISION 2
5th Storey
GROUP A, DIVISION 2
GROUP A, DIVISION 1
4th Storey
GROUP A, DIVISION 1
GROUP A, DIVISION 1
GRADE
3rd Storey
GROUP A, DIVISION 1
GROUP E
2nd Storey
GROUP E
STORAGE GARAGE
First Storey
STORAGE GARAGE
200m
100m
50m

Note:

1. Building is sprinklered throughout.

FIGURE 4-14

EXERCISE #4-3

Read Sentences 3.2.3.1.(1), (2), (4), (5), (6), and (7) and Article 3.2.3.2. and consider Figure 4-15.

1. Calculate the area of unprotected opening(s) permitted in the south exposing building face. The known values are as follows:

   - The limiting distance is 4.0 m.
   - Fire compartment 'A' is 50 m by 5 m at the EBF.
   - Fire compartment 'B' is 100 m by 5 m at the EBF.
   - The building is a Group D occupancy.
   - The building is not sprinklered.

The 1 h fire separation between the D occupancies permits the area of EBF to be calculated for each fire compartment - Sentence 3.2.3.2.(2).

1. LD = 4.0 m

2. The area of fire compartment A = (50 m) x (5 m) = 250m^2
L/H ratio 50/5 = 10:1; ∴ 3:1 to 10:1
D occupancies

The area of fire compartment B = (100 m) x (5 m) =
500 m^2
L/H ratio 100/5 = 20:1; ∴ over 10:1
D occupancies

3. To calculate the permitted area of UO for fire compartment A: Read directly from Table 3.2.3.1.A.

For an EBF of 250 m^2 with a limiting distance of 4 m, Table 3.2.3.1.A. lists a maximum UO of 12% of the EBF area.

Therefore, the area of UO = 250 m^2 x 12% = 30 m^2

Fire compartment A having a 250 m^2 EBF allows a maximum unprotected opening area of 30 m^2.

1. LD = 4.0 m

2. The area of fire compartment B = (100 m) x (5 m) =
500 m^2
L/H ratio 100/5 = 20:1; ∴ over 10:1
D occupancies

3. To calculate the permitted area of UO for fire compartment B: read directly from Table 3.2.3.1.A.

For an EBF of 500 m^2 with a limiting distance of 4 m, Table 3.2.3.1.A. lists a maximum UO of 14% of the EBF area.

Therefore, the area of UO= 500 m^2 x 14% = 70 m^2

Fire compartment B having a 500 m^2 EBF allows a maximum unprotected opening area of 70 m^2.

2. Read Sentence 3.2.3.1.(4). Review Figure 4-16 and state how you would determine the allowable percentage of unprotected openings when the limiting distance is not constant.

Sentence 3.2.3.1.(4):

To determine the percentage of UO, the LD may be taken from the EBF of the building or fire compartment projected onto a vertical plane at the unprotected opening closest to the property line, centre line of a street, or to the imaginary line between two buildings on the same property.
∴ LD = 6 m

3. A sprinklered building having Group D and Group F Division 1 occupancies, has an

exposed building face with the following characteristics.

Group D occupancy has 30% maximum allowable unprotected openings Group F, Division 1 occupancy - 40% unprotected openings

Describe the construction of the exposed building faces. The exposed building face has a limiting distance of 5.0 m to the property line.

____

___________________________[____________]

Sentence 3.2.3.7.(3) - the Group D occupancy of an exposed building face requires a fire-resistance rating not less than 45 minutes.

Sentence 3.2.3.7.(6) - the Group F, Division 1 occupancy exposed building face shall be of noncombustible construction having a fire-resistance rating of not less than 1 h.

---

4. An exit stair enclosure has an opening in the exterior wall. The enclosure forms an angle of 75º with the plane of the exterior wall of the building. The exterior wall of the building also has an opening located 10.5 m horizontally and 1 m above the opening in the exterior wall of the exit.

   Are the openings in the building or exit enclosure required to be protected?

   ____

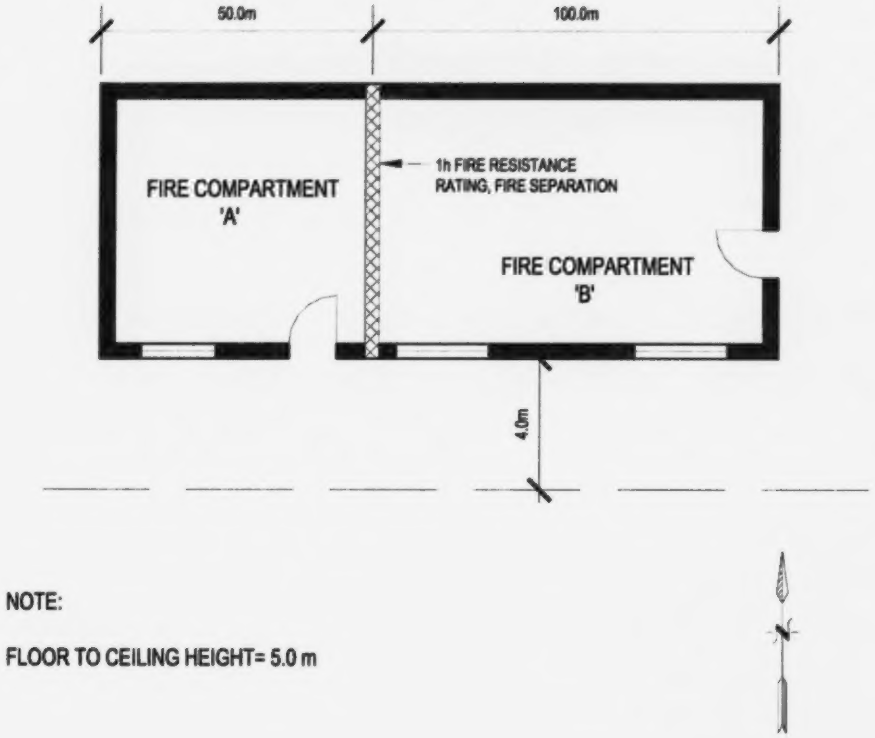
   ____

   ____

   ___________________________[____________]

   No. [3.2.3.13.(1)(a) and (b)] The opening in the building is located more than 3 m horizontally from the opening in the exit enclosure.

   *Although the opening in the building is 1 m above the opening in the exit enclosure, the requirements state openings must be protected where they are less than 3 m horizontally **and** less than 2 m above the opening in the exterior wall of the exit.*


50.0m
100.0m
FIRE COMPARTMENT 'A'
1h FIRE RESISTANCE RATING, FIRE SEPARATION
FIRE COMPARTMENT 'B'
4.0m

NOTE:

FLOOR TO CEILING HEIGHT= 5.0 m

FIGURE 4-15

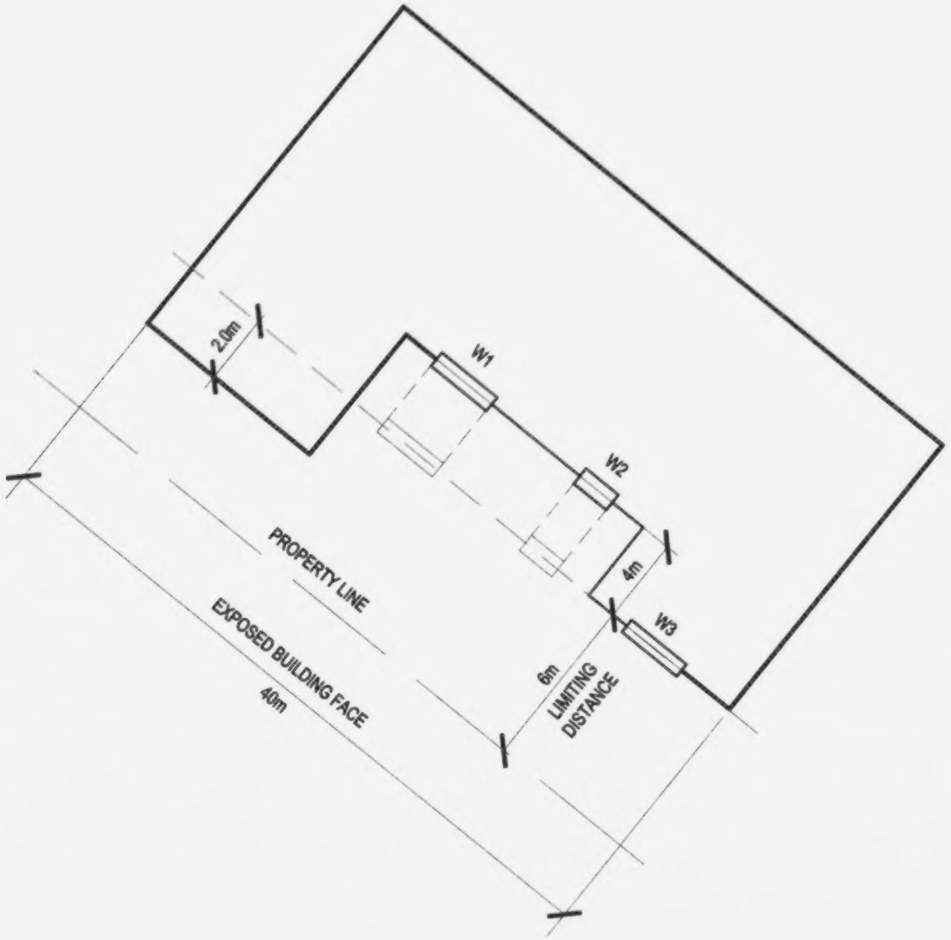

2.0m
W1
W2
4m
W3
PROPERTY LINE
EXPOSED BUILDING FACE
40m
6m
LIMITING DISTANCE

FIGURE 4-16

EXERCISE #5-1

Take 10 minutes to familiarize yourself with Subsection 3.2.5.

Refer to Figure 5-7 and Articles 3.2.5.5. and 3.2.5.6. to complete the following exercise. Take 10 minutes.

The building in the illustration is 3 storeys in building height, Group C major occupancy (apartment building), is not sprinklered, is provided with a fire alarm system and has a building area of 2,300 m^2. The building is required to face one street.

1. State below, for each alphabet symbol found on Figure 5-7, the required dimension in compliance with Articles 3.2.5.5. and 3.2.5.6. Identify whether this requirement is 'maximum permitted' or 'minimum required', and the Code references to support your answer.

   a) ____________________________[________________]

   b) ____________________________[________________]

   c) ____________________________[________________]

   d) ____________________________[________________]

   a) minimum 12 m [Clause 3.2.5.6.(1)(b)]

   b) not more than 45 m [Clause 3.2.5.5.(2)(c)] and [Sentence 3.2.5.5.(3)]

   c) 5 m minimum required overhead clearance [Clause 3.2.5.6.(1)(c)]

   d) Gradient not to exceed 12.5:1[Clause 3.2.5.6.(1)(d)]

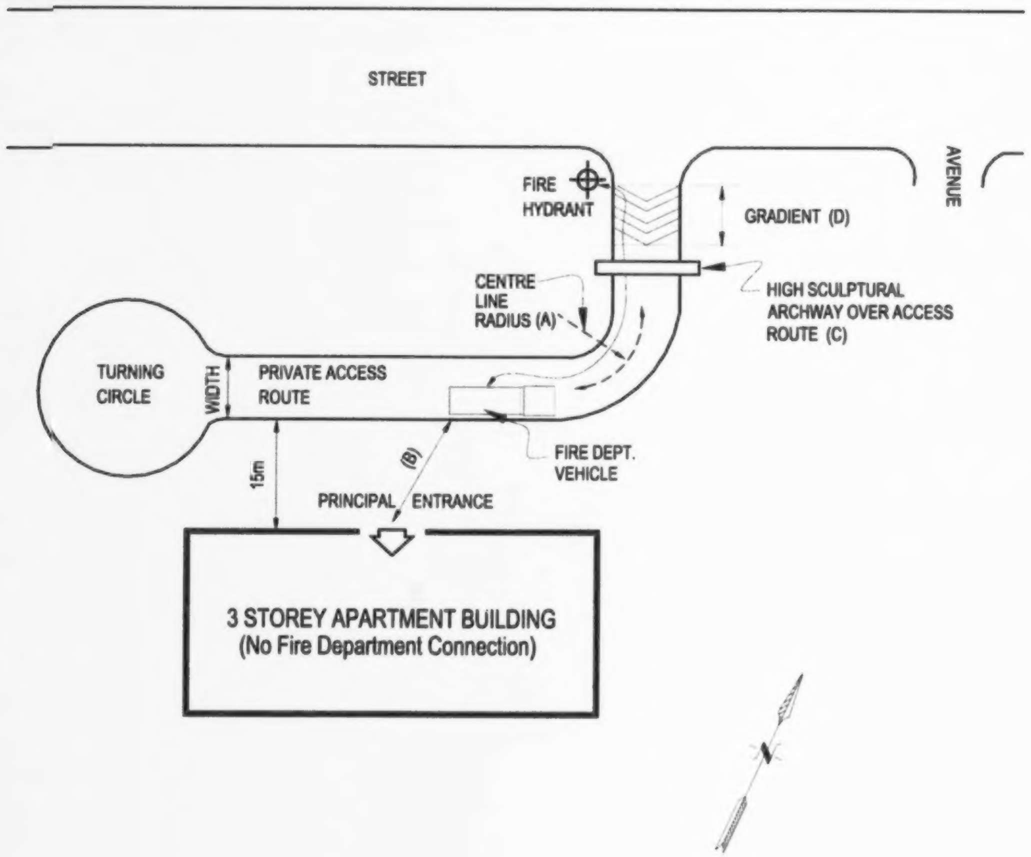

STREET
AVENUE
FIRE HYDRANT
GRADIENT (D)
HIGH SCULPTURAL ARCHWAY OVER ACCESS ROUTE (C)
CENTRE LINE RADIUS (A)
TURNING CIRCLE
WIDTH
PRIVATE ACCESS ROUTE
FIRE DEPT. VEHICLE
(B)
15m
PRINCIPAL ENTRANCE
3 STOREY APARTMENT BUILDING
(No Fire Department Connection)
N

FIGURE 5-7

EXERCISE #5-2

(Circle the correct answer and cite Code reference)

1. Combustible sprinkler piping for wet systems is permitted by Subsection 3.2.5 in:

   a) Commercial occupancies up to 1 storey in building height

   b) Only residential occupancies

   c) Light hazard occupancies

   d) Any occupancy, other than Group F, Div.1 and 2, up to 3 storeys.

   ______________________________ [______________]

   c) *Light hazard occupancies* [Sentence 3.2.5.14.(1)].

2. Combustible sprinkler piping is not required to be separated from the space it serves:

   a) where plywood not less than 9.5 mm thick is used to protect the piping

   b) if it meets ULC/ORD-199P-M

   c) if it is tested in accordance with ULC/ORD-199P-M and has shown to meet the requirements in that document without additional protection.

   ______________________________ [______________]

   c) *It has to be shown to meet these requirements without additional protection. [3.2.5.14.(5)]*

3. Sprinkler protection is not required in a space below a raised floor in a computer room provided specific conditions are met. Which statement below is not an applicable condition?

   a) The optical fibre cables and electrical wires and cables located below a raised floor are installed in noncombustible raceways.

   b) The building must be of noncombustible construction and combustible components are permitted in compliance with Subsection 3.1.5.

   c) The space below a raised floor must be easily accessible by access sections or panels in the raised floor.

   ____

   ______________________________ [______________]

   a) Optical fibre cables and electrical wires and cables located below a raised floor are not restricted to noncombustible raceways. Clause 3.2.5.15.(4)(a) requires such cables to comply with the test criteria in Article 3.1.5.21. That Article does not require noncombustible raceways.

4. Consider a building with a standpipe system. The fire department connection for the standpipe system must be located:

   a) Outside of a building within 6 m of a street or an access route.

   b) Outside of a building within 900 mm of a street or an access route.

   c) Outside of a building adjacent to a street or an access route.

   ____

   ______________________________ [______________]

   c) *Outside of a building adjacent to a street or an access route [Clause 3.2.5.16.(3)(a)].*

EXERCISE #5-3

Circle the correct answer and cite the applicable Code requirement.

1. Consider a building with a building height of 14 m and not sprinklered. Which one of the following building areas, occupancy classification and number of storeys will require the installation of a standpipe system?

   a) occupancy classification D, 1 storey, 2,000 m^2

   b) occupancy classification F, Division 3, 2 storeys, 1,500 m^2

   c) occupancy classification A, 3 storey, 2,000 m^2

   d) occupancy classification C, 2 storeys, 1,000 m^2

______________________________[______________]

c) *Not >14 m high, but area is greater than 1,500 m^2 [refer to Sentence 3.2.9.1.(1)]*

2. Consider a building that requires a standpipe system and includes a rooftop enclosure. Which one of the following enclosure floor areas requires a standpipe hose station?

   a) 50 m^2
   b) 55 m^2
   c) 5 m^2
   d) none of the above

______________________________[______________]

b) *Refer to Sentence 3.2.9.1.(5)*

EXERCISE #5-4

Circle the correct answer and cite applicable Code requirement.

1. In a sprinklered building, the Code permits the residual water pressure in a standpipe system to be less than 450 kPa under a set of conditions. Which one of the following is a specific part of that set of conditions?

   a) The water supply for the sprinkler system is sufficient to meet the flow demands at the base of the riser for the sprinkler system + the inside and outside hose allowance demand.

   b) provided that the demand does not exceed 1890 L/min

   c) any dry standpipes are connected to a water supply

   d) is only applicable for the 65 mm hose connection.

______________________________[______________]

a) *Refer to Clause 3.2.9.2.(4)(b)*

2. Based on Article 3.2.9.2., dry standpipe systems are:

   a) not permitted by the Code,

   b) permitted by the Code provided it is connected to a water source,

   c) required by the Code to be pressurized with nitrogen,

   d) are only permitted in sprinklered buildings.

______________________________[______________]

b) *Refer to Sentence 3.2.9.2.(8)*

EXERCISE #5-5

Circle the correct answer and cite the applicable Code requirement.

1. Consider a building that is 25 m (82 ft) high and requires a standpipe system. Which one of the following conditions meet the requirements of the Code?

   a) a building area of 4,000 m^2, 65 mm connections required,

   b) a building area of 4,310 m^2, 65 mm connections required,

   c) a building area of 4,000 m^2, no 38 mm connections,

   d) a building area of 4,310 m^2, no 65 mm connections.

______________________________[______________]

b) *Building is not more than 25 m high but is greater than 4,000 m^2 [refer to Sentence 3.2.9.3.(2)].*

2. Complete the statement with the correct phrase.

   Based on Subsection 3.2.9., hose station cabinets:

   a) are required for all occupancies

   b) are not required where tampering may occur

   c) are not required in only high hazard industrial occupancies (Group F, Division 1)

   d) are not required in any industrial occupancy.

______________________ [__________]

d) *Refer to Sentence 3.2.9.4.(3)*

EXERCISE #5-6

For each of the following questions, review the presented text and use the applicable references to select the correct answer using the multiple choice method.

1. If a building requiring a standpipe system is 84 m high, what provision is required to conform to the water supply requirements in Subsection 3.2.9.?

   a) water flow is permitted to be supplied through the fire department connection,

   b) the water supply must be available for 45 minutes,

   c) the building must be served by not less than two sources of water supply from a public water system,

   d) supply must be supplemented by a private system.

   ______________________ [__________]

   c) *Refer to Sentence 3.2.9.7.(4)*

2. A building requires both 38 mm and 65 mm hose connections. Which one of the following water supply flow capacity is the standpipe riser required to be designed to?

   a) 1,890 L/min
   b) 945 L/min
   c) 450 L/min
   d) 380 L/min

   ______________________ [__________]

   a) *Although 380 L/min is also required by the 38 mm outlets, the standpipe riser must be designed to highest flow demand, in this case, 1,890 L/min [refer to Clause 3.2.9.7.(1)(a)].*

EXERCISE #6-1

Take 5 minutes to read Subsection 11.3.1. and answer the following question.

Circle the best answer and cite the applicable Code reference.

1. Consider a renovation project of an interior fit-up of the 8th floor of an office building. The floor area is a single tenant floor area. The scope of the project is to construct new demising partitions for offices in approximately 50% of the floor area. As a result, air supply diffusers need to be relocated. As a consequence, new sections of ducts are proposed for the new diffuser locations.

   Only short new duct runs will be installed. Which requirement is considered as most appropriate to apply to the new sections of ducts?

   a) The new duct sections are required to comply with "other parts of the Code".

   b) The new duct sections are permitted to "maintain the existing performance level".

   c) The renovation is considered as extensive renovation, and as such, new duct sections are required to comply with "other Parts of the Code" (new construction requirements).

   ____

   ____

   ______________________ [__________]

   b) *[Sentence 11.3.3.1. (1)] On the basis that the new short duct runs are an extension of the same or similar materials or components, and that these short ducts will not reduce the performance level of the building [11.3.1.1.].*

EXERCISE #6-2

Answer the following based on Tables 11.5.1.A through F.

1. What is a Part 11 Compliance Alterative for Article 3.2.4.21., which states that all smoke alarms are to be hard wired in a residential occupancy?

   ______________________ [__________]

   Such smoke alarms may be battery operated

[Table 11.5.1.1 C. # C18]

EXERCISE #7-1

1. In Section 5.2., how are interior environmental loads derived?

____

___________________________[____________]

Loads are derived from the intended use of the space [5.2.1.2.].

2. Refer to Article 5.3.1.2. and list the types of metal frame windows and doors that are exempt from the requirement for a thermal break. Give Code references.

____

___________________________[____________]

Metal framed storm windows or doors, or windows and doors required to have a fire-resistance rating [5.3.1.2.(3)].

3. When is a vapour barrier required in a building component or assembly?

____

____

___________________________[____________]

Where a building component or assembly is subjected to a temperature differential and a differential in water vapour pressure [5.5.1.1.(1)].

EXERCISE #7-2

1. What is the minimum design live load between two consecutive attachments in a fixed ladder?

____

___________________________[____________]

1.1 KN each [SB-8]

2. What type of anchor should be avoided when fastening a ladder onto a masonry wall?

____

___________________________[____________]

Expansion anchors [SB-8]

3. What should be done to provide an improved margin of safety for fixed access ladders?

____

___________________________[____________]

Two means of anchoring at the top of the ladder [SB-8]

EXERCISE #8-1

Take 30 minutes to complete the following questions.

1. Identify which of the following buildings are regulated by Subsection 3.2.6. (assume first storey is at grade).

   a) 15 storey office building having 3.5 m high storeys

   ____

   ___________________________[____________]

   14 x 3.5 = 49 m > 36 m, therefore high building [3.2.6.1.(1)(a)(i)]

   b) 4 storey hospital with patient care on all storeys. Storey heights are 4 m

   ____

   ___________________________[____________]

   B occupancy above the 3rd storey, therefore high building [3.2.6.1.(1)(c)]

   c) 6 storey residential building having 3.4 m storey height

   ____

____________________________[______________]

5 x 3.4 = 17 m < 18 m, therefore not a high building [3.2.6.1.(1)(c)]

2. Why is January selected as the month on which to base designs to limit smoke movement?

____

____

Cold temperatures result in large differences between indoor and outdoor temperatures, thereby accentuating stack effect and creating conditions for substantial smoke spread.

3. If a building is not sprinklered, how must it be designed to limit the danger to occupants and fire fighters from exposure to smoke in a building fire?

____

____________________________[______________]

It shall be designed in accordance with Supplementary Standard SB-4. [3.2.6.2.(6)]

EXERCISE #8-2

Take 15 minutes to read Articles 3.2.6.4. to 3.2.6.6. and complete the following questions.

1. Describe 2 conditions of use of windows for smoke venting.

____

____________________________[______________]

Fixed panes: must be located where breakage will not endanger pedestrians below [3.2.6.6.(2)].

____

____________________________[______________]

Operable panes: must be permanently marked to be easily identified [3.2.6.6.(3)].

2. Identify 2 locations where manual elevator recall switches are found.

a) ____

____________________________[______________]

elevator lobby at recall level [3.2.6.4.(4)(a)]

b) ____

____________________________[______________]

central alarm and control facility [3.2.6.4.(4)(b)]

3. Does an elevator serving only the first storey and 3 basement parking levels of a high building require emergency recall.

____

____________________________[______________]

No, 3.2.6.4.(1) and (5) requires emergency recall only if the elevator serves storeys above the first storey.

EXERCISE #8-3

Take 10 minutes to complete the following questions.

1. According to Article 3.2.4.22., operation of the voice communication system will temporarily silence fire alarm audible signals to permit voice message transmission, but only after the signals have operated for at least:

d) 10 seconds in

____

____________________________[______________]

Hospitals with 2 stage fire alarm systems and 24 hr/day supervisory personnel [3.2.4.22.(3)(a)]

e) 30 seconds in

____

____________________________[______________]

other occupancies [3.2.4.22.(2), 3.2.4.22.(3)(b)]

2. A voice communication system must be capable of transmitting voice messages selectively to:

____

____________________ [__________]

any zone or zones while maintaining alert or alarm signals to other zones in the building [3.2.4.22.(4)].

3. Identify the type of monitoring (audible and/or visual) required at the Central Alarm and Control Facility for the following functions:

Function	Monitoring Required		
	Audible	Visual	Code Reference
Fire alarm alert and alarm signals	*X*	*X*	*3.2.6.7.(2)(b)*
Elevator emergency recall		*X*	*3.2.6.7.(2)(c)*
Sprinkler system water flow		*X*	*3.2.6.7.(2)(k)*
Sprinkler supervisory signal	*X*	*X*	*3.2.6.7.(2)(l)*
Sprinkler supervisory audible signal silence switch		*X*	*3.2.6.7.(2)(n)*

EXERCISE #9-1

Take 10 minutes to read SB-4 "Introduction" and the first 3 pages of Section 2 "Scope of Measures for Fire Safety in Existing High Buildings" and answer the following question:

1. Which of the following are common requirements for all of the high building measures described in SB-4:

	Yes	No
Key operated elevator recall -	*X*	_
Firefighters' elevator -	*X*	_
Venting of floor areas to aid firefighters -	*X*	_
Certain floor areas to be sprinklered -	*X*	_
Limits on interior finish flame spread rating / smoke developed classification -	*X*	_
Central alarm and control facility -	*X*	_
Voice communication in buildings exceeding 36 m height -	*X*	_
Fire protection of emergency equipment power conductors -	*X*	_

Emergency power for fire alarm, voice communication and lighting -	*X*	_
Emergency power for elevators in buildings exceeding 36 m height -	*X*	_

EXERCISE #9-2

Take 15 minutes to complete Exercise #9-2. Review answers with your group to obtain consensus.

1. When a measure requires that stair shafts serving storeys above and below the lowest exit storey be separate from each other, the required fire resistance rating of an intervening fire separation is:

a) 45 minutes
b) 1 hour
c) 2 hours
d) equal to the shaft fire-resistance rating

____________________ [__________]

d) equal to the shaft fire-resistance rating [3A(3)(b)]

2. What is the minimum area of a vent to the exterior in a bridge or vestibule constructed to provide access between 2 smoke control regions in a building designed to comply with Measure K?

____________________ [__________]

$1\ m^2$ [3K(11)(a)]

3. A stair shaft enclosure in a fully pressurized 40 storey building is penetrated with one weatherstripped door at each storey. The required air supply to the shaft during a fire emergency is:

a) $3.76\ m^3/s$
b) $4.42\ m^3/s$
c) $5.68\ m^3/s$
d) $7.56\ m^3/s$

____________________ [__________]

a) $0.094\ m^3/s$/door x 40 doors = $3.76\ m^3/s$ [3H(2)(b)]

4. A high building is designed in conformance with Measure D. An elevator serving storeys from street level to the 24th storey is protected with vestibules with a mechanical air supply in accordance with 3D(5)(b). What is the minimum area of the relief vent required near the bottom of the elevator shaft?

   a) 0.02 m^2
   b) 0.4 m^2
   c) 0.46 m^2
   d) 0.48 m^2

   ____

   ____________________[__________]

   c) 0.02 m^2/door x 23 doors (street level excluded)
   = 0.46 m^2 [3D(9)]

EXERCISE #9-3

Take 10 minutes to complete Exercise #9-3. Review answers with your group to obtain consensus.

1. A stairway serving 52 storeys above grade is vented to the exterior in accordance with Measure A(2). There is one door to the stairway at each floor level. The required exterior vent area is:

   a) 1.8 m^2
   b) 2.6 m^2
   c) 4.2 m^2
   d) 5.2 m^2

   ____

   b) 0.05 m^2/door x 52 doors = 2.6 m^2 [3A (4)]

2. A stairway serving 4 storeys below the lowest exit storey is required to be pressurized for compliance with Measure 2D(8). Calculate the required rate of stair pressurization.

   a) 0.47 m^3/s
   b) 0.20 m^3/s
   c) 0.65 m^3/s
   d) 1.88 m^3/s

   ____

   d) 0.47 m^3/s/storey x 4 storeys = 1.88 m^3/s [3D (8)]

3. If each level of the stair in question (2) has 2 weatherstripped doors, the required exterior vent area is:

   a) 0.24 m^2
   b) 0.32 m^2
   c) 0.36 m^2
   d) 0.40 m^2

   ____

   b) (0.1 m^2/storey x 4 storeys) - (0.01 m^2/door x 8 doors) = 0.32 m^2 [3A (3)]

EXERCISE #10-1

Take 5 minutes to complete the following questions. Give the Code references where applicable.

1. In a multi-tenant building regulated by Article 3.2.2.55., the floor assemblies are constructed of noncombustible construction without a fire-resistance rating. What fire separation is required for the public corridors that are 2 m wide?

   a) 0 h smoke separation
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation required

   ____

   ____________________[__________]

   b) ¾ h, [Sentence 3.3.1.4.(2)]

2. A public corridor in a sprinklered commercial mall is 9 m wide and complies with Clause 3.3.1.4.(4)(b). What is the fire separation requirement for the demising wall between the tenant spaces that are occupied as business and personal service or mercantile occupancies?

   a) 0 h smoke separation
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation

   ____

______________________________[______________]

d) No suite fire separations required by Sentence 3.3.1.1.(3)

3. In a sprinklered high-rise apartment building regulated by Article 3.2.2.42., what is the fire separation requirement between the public corridor and the dwelling units?

   a) 0 h smoke separation
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation required

   ____

   ______________________________[______________]

   b) ¾ h, as the waiver of the rating for sprinklered floor areas does not apply to residential occupancies Sentences 3.3.1.4.(2) and (3)

4. A public corridor serves a dwelling unit and four offices on the second floor of a three storey unsprinklered commercial building with five offices on the third floor. Each tenant space is 200 m^2. The building is regulated by Articles 3.2.2.53. and 3.2.2.46. What fire separation is required for the public corridor on the third floor?

   a) 0 h if of noncombustible construction
   b) ¾ h fire separation
   c) 1 h fire separation
   d) no separation required

   ____

   ______________________________[______________]

   b) ¾ h, Sentence 3.3.1.4.(2).

EXERCISE #10-2

Review Subsections 3.3.2. to 3.3.5., and 3.6.2. and answer the following questions.

1. In a high-rise apartment building, there is a common locker/storage area for the tenants on the ground floor. The room must be:

   a) sprinklered
   b) fire separated from the remainder of the building by a 1 h fire separation
   c) both (a) and (b)

   d) fire separated from the public corridor by a ¾ h fire separation.

   ____

   c) both (a) and (b) [3.3.4.3.(1) and (2)]

2. What fire separation is required between a cafeteria with seating for 250 students, and a kitchen, in a sprinklered secondary school?

   a) 30 min
   b) ¾ h fire separation
   c) 1 h fire separation
   d) 2 h fire separation
   e) no separation required

   ____

   ______________________________[______________]

   a) 30 min in accordance with Sentence 3.3.2.2.(8) and (9)

3. What fire separation is required between a parking garage and an adjacent sprinklered garbage room in an apartment building?

   a) ¾ h fire separation
   b) 1 h fire separation
   c) 1½ h fire separation
   d) 2 h fire separation
   e) no separation required

   ____

   ______________________________[______________]

   c) 1 ½ h in accordance with Article 3.3.5.6. (see also 3.6.2.5. for Garbage Room).

EXERCISE #10-3

1. An office suite in a Group D sprinklered building will require two means of egress when:

   a) the suite is greater than 100 m^2 in area
   b) the suite is greater than 200 m^2 in area
   c) the suite is greater than 300 m^2 in area
   d) the travel distance to an egress door is 25 m

   ____

   c) the suite is greater than 300 m^2 in area [3.3.1.5.(1)]

2. A mezzanine in a Group F2 occupancy is not required to terminate at a vertical fire separation by Subsection 3.2.8. and is in a sprinklered floor area. The travel distance from any point on the mezzanine to the top of the stair providing egress from the mezzanine is 25 m. The suite in which the mezzanine is located has two means of egress. How large can the mezzanine be to have a single means of egress?

   a) 150 m^2
   b) 200 m^2
   c) 300 m^2
   d) no area restriction provided the travel distance does not exceed 25 m

   ____

   ____

   ____________________ [__________]

   b) 200 m^2 maximum [3.3.1.5.(2)(d)(ii)]

3. What is the maximum area of a hazardous classroom in a sprinklered secondary school if the room has only a single means of egress?

   a) 100 m^2
   b) 150 m^2
   c) 200 m^2
   d) no area restriction provided the travel distance does not exceed 25 m

   ____________________ [__________]

   a) 100 m^2 [3.3.1.5.(1)(e)]

4. In a sprinklered office building, a tenant has a suite with an area of 320 m^2 and has two egress doorways. What is the maximum travel distance from any point in the suite to the nearest egress doorway?

   a) 25 m
   b) 30 m
   c) 40 m

d) 45 m

   ____________________ [__________]

   d) 45 m [3.3.1.6.(1)]

EXERCISE #10-4

1. A classroom in a secondary school has a total occupant load of 60 persons. The room has a single egress door. The door may swing into the classroom. True or False?

   ____

   ____________________ [__________]

   True, the occupant load is not more than 60 as permitted by Sentence 3.3.1.10.(2)

2. What is the minimum clear opening width of a doorway serving a meeting room in a non-barrier free accessible school. The room has a single means of egress and can accommodate up to 60 persons.

   a) 366 mm
   b) 600 mm
   c) 800 mm
   d) 850 mm

   ____

   ____________________ [__________]

   c) 800 mm [3.3.1.12.(1)(b)]

3. A tenant wishes to install an electromagnetic locking device (EMLD) on a door to a computer room in an office building. The room is permitted to have a single egress door and will have an occupant load of 15 persons. The EMLD will be installed in accordance with Sentence 3.4.6.15.(4) and may be unlocked by the activation of a pull station located on the room side of the door. Is this locking device permitted, or does it contravene Sentences 3.3.1.12.(2) and (3)?

   ____

   ____________________ [__________]

   It is permitted by Sentence 3.3.1.12.(10)

4. A 10 m long dead-end corridor serves two Group F2 industrial tenants on the ground floor of a six storey sprinklered building. Each tenant space is provided with an exit door that opens directly to the exterior. The corridor is separated from each tenant space by a ¾ h fire separation. What is the maximum travel distance permitted from the tenant egress doors through the corridor to the exterior?

   a) 25 m
   b) 30 m

c) 45 m
d) no restriction on maximum travel distance

____

____

____

____________________ [__________]

c) Although there is no maximum length specified for a dead-end corridor when there is a second egress door from a suite, the maximum travel distance from any point in a floor area in a sprinklered building is 45 m [3.3.1.6.(1), 3.3.1.9.(13)]

5. What is the minimum height of a guard at the foot of a stepped aisle serving a balcony in a theatre?

a) 660 mm
b) 760 mm
c) 920 mm
d) 1,070 mm

____

____________________ [__________]

c) 920 mm [3.3.2.8.(1)(a)(ii)]

EXERCISE #10-5

1. In an outdoor sports stadium, what is the maximum travel distance from any seat in the seating area to a vomitory leaving the seating area?

a) 25 m
b) 30 m
c) 45 m
d) 60 m

____________________ [__________]

c) 45 m, as per Sentence 3.3.2.9.(2)

2. What is the minimum height of a guard in the front of seats in the balcony of a theatre?

a) 660 mm
b) 760 mm
c) 920 mm
d) 1,070 mm

____________________ [__________]

b) 760 mm, according to Subclause 3.3.2.8.(1)(a)(i)

3. What is the maximum length of a dead-end aisle in a classroom with fixed seats if the classroom is not fire
separated from adjacent classrooms or the corridor?

a) 6 m
b) 9 m
c) 10 m
d) 25 m

____________________ [__________]

a) 6 m, as per Sentence 3.3.2.4.(12)

4. What fire separation is required between a kitchen and a cafeteria in an unsprinklered secondary school with an occupant load for 200 persons?

a) 0 h
b) 30 min
c) 1 h
d) no separation required

____________________ [__________]

d) as there is seating for not more than 200 persons [3.3.2.2.(8)]

5. What minimum row spacing is required in a theatre that has two aisles with 30 seats between the aisles?

a) 400 mm
b) 485.4 mm
c) 497.6 mm
d) 583 mm

____________________ [__________]

b) 400 + 14 x 6.1 = 485.4 mm, as per Subclause 3.3.2.3.(5)(c) (see Figure 10-3 for illustration)

6. What is the minimum riser height for a step in an aisle of a theatre?

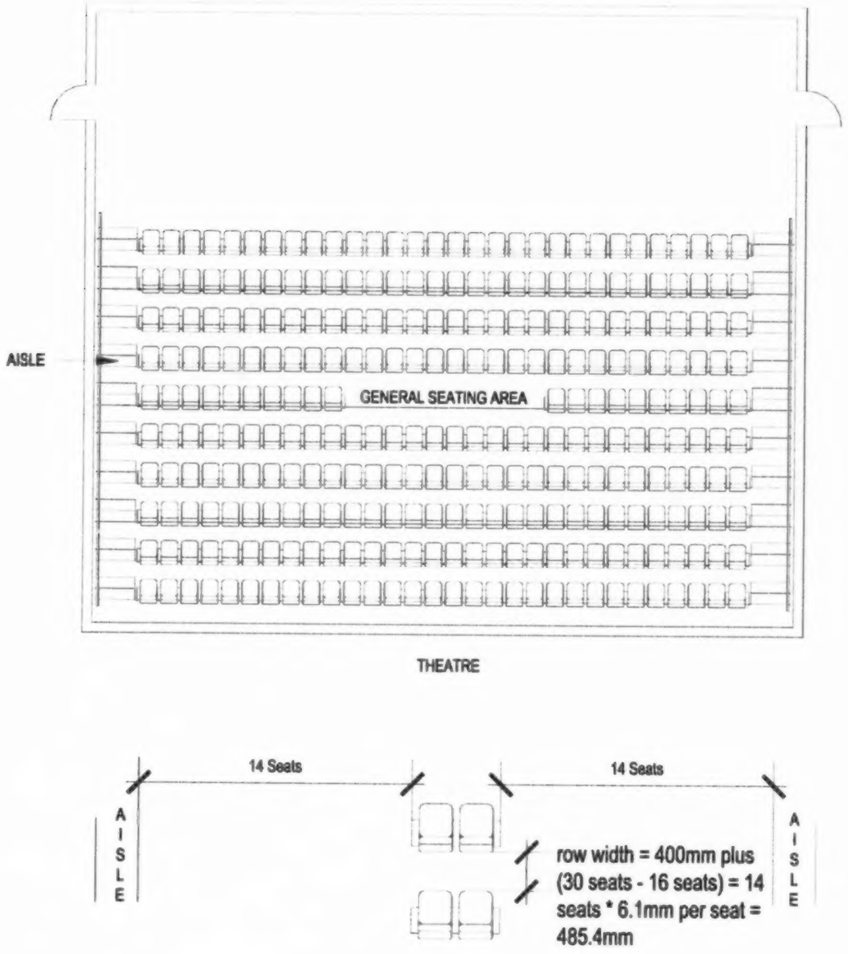
a) 100 mm

b) 110 mm
c) 125 mm
d) 200 mm

______________________ [   ]

b) as per Clause 3.3.2.4.(21)(a)

Illustration for Question 5, EXERCISE # 10-5


AISLE
GENERAL SEATING AREA
THEATRE
14 Seats
14 Seats
AISLE
AISLE

row width = 400mm plus (30 seats - 16 seats) = 14 seats * 6.1mm per seat = 485.4mm

FIGURE 10-3

EXERCISE #10-6

Take 2 minutes to scan Subsection 3.8.1. and answer the following questions. Provide Code references with answers where applicable.

1. Which of the following types of buildings may require barrier-free design?

   a) high hazard industrial occupancies
   b) boarding and rooming houses
   c) buildings occupied on a part-time basis such as pump houses and substations
   d) houses, including townhouses and row houses

   b) Boarding or rooming houses serving 8 people or more [3.8.1.1.(1)(a)]

2. What is the total number of pedestrian entrances required to be barrier-free in a building that contains a total of (6) six entrances, where (4) four of the entrances serve mercantile occupancies, and (2) two entrances serve an assembly occupancy which is completely separated from the remainder of the building (i.e. assembly occupancy is not accessible via entrances serving mercantile occupancies)? Why?

   Three barrier-free entrances are required. The mercantile occupancy requires two barrier-free entrances. The assembly occupancy requires one barrier-free entrance because there is no other access from the mercantile occupancy [3.8.1.2.(2)] and Table 3.8.1.2 (refer to Figure 10-4).

3. If at a required barrier-free entrance there are six exterior doors, all doors are required to be designed in accordance with Section 3.8. True or false?

   False. Only one of the doors in a barrier-free entrance that includes more than one doorway is required to meet requirements of OBC Article 3.8.3.3.(13) [3.8.1.2.(4)]

4. The Code requires a barrier-free path of travel to be provided with an unobstructed space not less than 1,600 mm x 1,600 mm at certain intervals to allow persons in wheel chairs to pass one another. What is the maximum interval for these spaces.

   a) 25 m
   b) 30 m
   c) 45 m
   d) 60 m

   b) located not more than 30 m apart [3.8.1.3.(4)]

EXERCISE #10-7

Read Subsection 3.8.2. and answer the following questions.

1. Other than as required by Sentence 3.8.2.1.(4), the provision of a barrier-free path of travel for residential occupancies applies to which of the following:

   a) into suites that are located in storeys above the entrance storey and not served by an elevator
   b) into suites served by an elevator
   c) within all portions of suites served by an elevator
   d) egress from suites served by an elevator

   b) A barrier-free path of travel is required to the entrance of a suite served by an elevator [3.8.2.1.(2)(j)].

2. When is a balcony in a dwelling suite required to be barrier-free accessible? (Hint: Review requirements of Article 3.3.1.7.)

   Balconies are required to be used as an area of refuge where no elevator meeting the *high-rise requirements is provided for the rescue of persons requiring assistance, and where the barrier-free path of travel is not divided into at least two zones by a fire separation [3.3.1.7.(2)].*

3. Consider a shopping mall with a public corridor and a food court area with washrooms located within 45 m of the food court area. What are two possible options to meet the barrier-free washroom requirements?

____

____________________________ [__________]

____

____________________________ [__________]

Possible options:

a) provide barrier-free stalls in the washrooms serving the food court area [3.8.2.3.(1)]
b) provide separate barrier-free washrooms within 45 m of food court washrooms on the same level [3.8.2.3.(1)]

4. Consider a strip mall with individual mercantile suites. Which mercantile suites do not require a barrier-free washroom?

____

____________________________ [__________]

____

____________________________ [__________]

Suites which have an area less than 300 m^2, provided that the strip mall is served with public washrooms that are designed to accommodate disabled persons in conformance with Articles 3.8.3.8. to 3.8.3.12. [3.8.2.3.(1) and (3)].

EXERCISE #10-8

Take 20 minutes to answer the following questions located in Subsection 3.8.3.

1. What is the minimum clear width of a door serving a bathroom in a barrier-free path of travel in a residential occupancy if the corridor serving the bathroom is 1,070 mm wide?

a) 760 mm
b) 790 mm
c) 810 mm
d) 900 mm

____

____________________________ [__________]

a) 760 mm door width, Sentence 3.8.3.3.(2)

2. What is the latch side clearance of a bathroom door located in a residential suite not regulated by Sentence 3.8.2.1.(4) that swings towards the approach side? Explain.

____

____________________________ [__________]

Not applicable. The clearance requirement does not apply within the suite [3.8.2.1.(2)(k)].

3. What is the minimum clearance within a barrier-free water closet stall that will permit the stall door to swing into the stall?

____

____________________________ [__________]

760 mm x 1,220 mm clear floor area provided within the stall [3.8.3.8.(1)(b)(iii)]

4. What is the minimum dimension of a universal barrier-free washroom?

a) 1,100 mm
b) 1,200 mm
c) 1,500 mm
d) 1,700 mm

____

____________________________ [__________]

d) 1,700 mm, 3.8.3.12.(1)(f)

5. If a Group B occupancy contains individual shower stalls, what is the required mounting height above the floor of a folding seat that is not spring loaded and is located in a barrier-free shower?

a) 400 mm
b) 430 mm
c) 450 mm
d) 460 mm

______________________________ [______________]

c) 450 mm is the mounting height prescribed [3.8.3.13.(2) and 3.8.3.13.(1)(e)(ii)]

EXERCISE #11-1

Refer to Articles 3.2.4.1. and 3.2.4.2., and using the above procedure, answer the following questions.

(Circle the correct answer and cite Code reference)

1. Is a fire alarm system required for a two storey building where both storeys are classified as Group F, Division 2 industrial occupancy, and the occupant load of each storey is 60 persons?

   a) Yes
   b) No

   ____

   ______________________________ [______________]

   b) No. A fire alarm system is required only if the occupant load of the second floor (medium hazard industrial occupancy) exceeds 75 persons [3.2.4.1.(2)(h)].

2. Refer to Figure 11-1. A two storey addition is proposed to be constructed to the one storey existing building located at the northwest corner of North Shore Avenue and Sunset Beach Road.

   The addition will be separated from the existing building by a fire separation with a minimum 1 h fire-resistance rating.

   The existing one storey building is a restaurant with an occupant load of 143 persons. The two storeys of the addition will be used for offices. The calculated occupant load of the ground floor addition is 85 persons and the second floor is 90 persons.
   Only building service pipes and electrical wiring in noncombustible raceways penetrate the 1 h fire separation. There are no communicating openings in the 1 h fire separation. Which statement below is correct?
   a) The entire building is required to be provided with a fire alarm system.

b) Only one suite is required to be equipped with a fire alarm system.

c) No fire alarm system is required.

____

____

____

____

______________________________ [______________]

c) No fire alarm system is required. Each side of the 1 h rated fire separation is permitted by Sentence 3.2.4.2.(4) to be evaluated separately for determining fire alarm requirements.

Neither side of the 1 h rated fire separation exceeds the criteria in Sentence 3.2.4.1.(2) for requiring a fire alarm system.

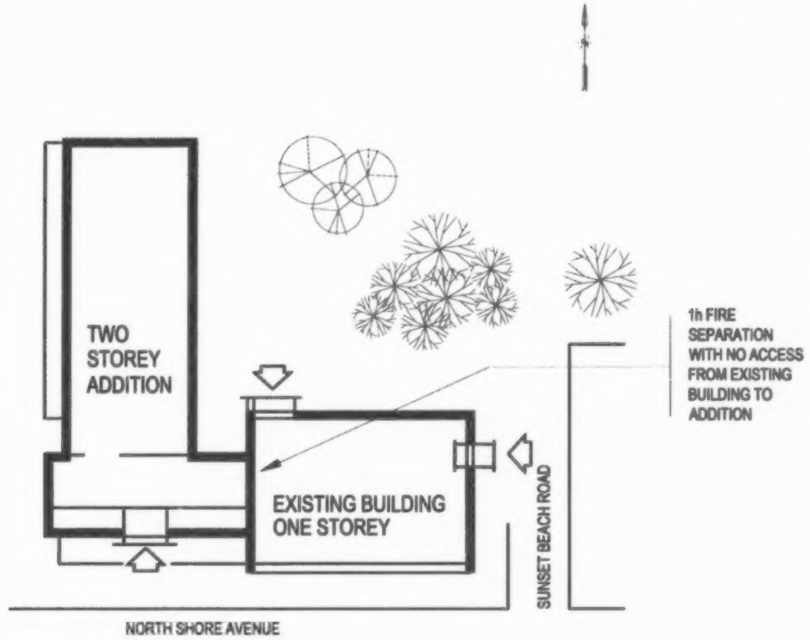

TWO STOREY ADDITION
EXISTING BUILDING ONE STOREY
1h FIRE SEPARATION WITH NO ACCESS FROM EXISTING BUILDING TO ADDITION
SUNSET BEACH ROAD
NORTH SHORE AVENUE

FIGURE 11-1

EXERCISE #11-2

(Circle the correct answer and cite Code reference)

1. Where a fire alarm system is required, visual alarm signal devices must be provided:

   a) in a compartment referred to in Article 3.3.3.6.

   b) where ambient noise levels exceed 75 dBA

   c) in an assembly occupancy in which music and other sounds associated with a performance may exceed 100 dBA.

   d) in a normally occupied space where the required sound pressure level of the fire alarm audible devices are 10 dBA below the required level.

   ____

   ______________________________ [______________]

   e) *In an assembly occupancy in which music and other sounds associated with a performance may exceed 100 dBA [3.2.4.19.(8)].*

EXERCISE #11-3

(Circle the correct answer and cite Code reference)

1. Under what conditions are annunciator panels not required for fire alarm systems?

   a) A building not more than 3 storeys in building height that does not exceed an aggregate floor area of 2,000 m^2 for all storeys.

   b) A building not more than 3 storeys in building height that does not exceed 20,000 m^2 in building area

   c) Where not more than two zones are required.

   ______________________________ [______________]

   a) Refer to Sentence 3.2.4.8.(5)

EXERCISE #11-4

(Circle the correct answer and cite Code reference)

1. Where is a smoke detector required to be used:

   a) in a janitor's room

   b) in every room in buildings classified as Group A, Division 1

   c) in every corridor in parts of a building classified as Group A, Division 1 major occupancy.

   ______________________________ [______________]

   c) Refer to 3.2.4.11.(1)(c).

2. Sprinklers are permitted by Subsection 3.2.4. in lieu of fire detectors provided:

   a) The sprinkler system is electrically supervised.

   b) The sprinkler system is a wet system.

   c) The building is not subject to the requirements of Subsection 3.2.6.

   d) The sprinkler system is monitored.

   ______________________________ [______________]

   a) Refer to Sentence 3.2.4.15.(1).

EXERCISE #11-5

(Circle the correct answer and cite the Code reference)

1. Based on Subsection 3.2.7., what is the minimum required duration for emergency power for lighting in a hospital that is not within the scope of Subsection 3.2.6.?

   a) 1 h
   b) 2 h
   c) 30 min

   ____

____

______________________________ [______________]

a) The building is classified as a Group B major occupancy that is not within the scope of 3.2.6. (high building) [3.2.7.4.(1)(b)(ii)].

2. Which statement below is correct regarding emergency power to provide adequate water supply for firefighting for buildings not regulated under Subsection 3.2.6.?

   a) Emergency power is not required to provide adequate water supply to a standpipe system.
   b) Emergency power is required to provide adequate water supply to a standpipe system.
   c) Emergency power is required to provide adequate water supply to a sprinkler system.

   ____

   ____

   ______________________________ [______________]

   a) Standpipe systems are exempt by Sentence 3.2.7.9.(5) from emergency power for a water supply to a standpipe system.

EXERCISE #12-1

1. Which of the following shall not be constructed as part of an interconnected floor space? Give Code reference.

   a) A floor area containing sleeping rooms

   b) A floor area containing washrooms

   c) a floor area containing sleeping rooms in a building of B2 or B3 major occupancy

   d) A floor area containing sleeping rooms in a building of Group B major occupancy.

   ______________________________ [______________]

   c) [3.2.8.1.(3)]

2. A mezzanine does not need to terminate at a vertical fire separation nor be protected in conformance with Articles 3.2.8.3. to 3.2.8.11. provided the mezzanine (give Code reference):

   a) serves a Group C occupancy

b) serves a Group A, Division 3 major occupancy in a building not more than three storeys in building height

c) serves a Group A, Division 1 major occupancy

______________________________[__________]

c) [3.2.8.2.(1)(a)]

EXERCISE #13-1

1. In a sprinklered 10-storey office building (Article 3.2.2.49) containing an interconnected floor space that consists of storeys one through four, what is the travel distance limit on the third storey?

____

______________________________[__________]

40 m, [3.2.8.4.(4)]

2. In the office building described above, if a portion of the fourth storey is separated from the interconnected floor space by a 2 h fire separation and has access to two exits without travelling through the interconnected floor space, what is the travel distance limit for that portion of the fourth storey?

____

______________________________[__________]

45 m, [3.2.8.4.(4)]

3. In the office building described in Question 1, what is the travel distance limit for the first storey having exterior exit doors at ground level?

____

______________________________[__________]

45 m, [3.2.8.4.(4)]

---

4. In Sentence 3.2.8.4.(6), the required minimum area of temporary refuge provided by stair treads and landings for an occupant load of 240 persons is:

a) 48 m^2
b) 72 m^2
c) 100 m^2
d) 120 m^2

____

______________________________[__________]

b) 240 x 0.3 = 72 m^2

EXERCISE #13-2

1. In Article 3.2.8.5., is it acceptable to pressurize the elevator shaft in lieu of elevator door vestibules that are pressurized in an emergency?

____

______________________________[__________]

No, [3.2.8.5.(1)]

2. Elevator vestibules are required when the building is more than __ m high, measured from the floor level of the top storey to grade:

a) 18 m
b) 25 m
c) 36 m
d) 75 m

______________________________[__________]

18 m, [3.2.8.5.(1)]

3. What are the two options for the location of elevator vestibules?

____

____

______________________________[__________]

Provide vestibule for elevator doors that open into the interconnected floor space, except for the lowest level; or provide vestibule for elevator doors on storeys above the interconnected floor space [3.2.8.5.(1) & (2)].

EXERCISE #13-3

1. Which storeys are required to be sprinklered in a 16-storey office building (that is not a high building) containing an interconnected floor space consisting of storeys 1 through 5? The building includes three basement levels.

a) storeys 1 through 5

b) storeys 1 through 16

c) storeys 1 through 5 and 1 basement level

d) storeys 1 through 5 and 3 basement levels

______________________ [______________]

d) storeys 1 through 5 and 3 basement levels [3.2.8.7.(1)]

EXERCISE #13-4

1. If the volume of an interconnected floor space with mechanical exhaust at the top is 15,000 m^3, how many air changes per hour are required?

a) 2
b) 4
c) 6
d) 8

______________________ [______________]

c) 6 [3.2.8.9.(6)]

2. If the volume in item 1 above is 20,000 m^3, how many air changes per hour are required?

a) 2
b) 4
c) 6
d) 8

______________________ [______________]

c) 4 [3.2.8.9.(6)]

3. If the total volume of an interconnected floor space is 34,000 m^2, comprised of zoned exhaust at 16,000 m^3 and atrium exhaust at 18,000 m^3, how many air changes are required for the atrium?

a) 2
b) 4
c) 6
d) 8

______________________ [______________]

b) 4 [3.2.8.9.(5)]

How many air changes are required for the floor area zoned exhaust?

a) 2
b) 4
c) 6
d) 8

______________________ [______________]

c) 6 [3.2.8.9.(4)]

4. Are smoke detectors required at the top of an atrium?

____

____

______________________ [______________]

Yes, [3.2.8.9.(7)] requires that if zoned exhaust has not been activated, detection of smoke within the interconnected floor space must activate the exhaust.

EXERCISE #13-5

1. The top storey of a building containing an interconnected floor space is 18 m above grade. What is the required duration of emergency power for the operation of the smoke control systems (not considering Articles 3.2.6.2. and 3.2.6.10.)?

a) 2 h
b) 1 h

c) 30 minutes
d) 0 h

______________________[______________________]

d) *0 h [3.2.8.10.(1)]*

EXERCISE #13-6

Read Article 3.2.8.9. Compare the top-exhaust method to the zoned-exhaust method of smoke control by completing the following chart. Class discussion begins in 20 minutes.

	Top-Exhaust System	Zoned-Exhaust System
Climactic design conditions for the smoke control system based on	*January design temperature on a 2.5% basis - Sentence 3.2.8.9.(2)*	*January design temperature on a 2.5% basis - Sentence 3.2.8.9.(2)*
Smoke control system activated by	*Two smoke detectors, or by activation of a sprinkler system - Sentence 3.2.8.9.(3)*	*Automatic detection of a fire - Sentence 3.2.8.9.(4)*
Number of air changes per hour for volumes less than 17,000 m^3	*Six air changes per hour - Sentence 3.2.8.9.(6)*	*Six air changes per hour - Sentence 3.2.8.9.(4)*
Number of air changes per hour for volumes more than 17,000 m^3	*Four air changes per hour - Sentence 3.2.8.9.(6)*	*Six air changes per hour - Sentence 3.2.8.9.(4)*
Location of manual override controls for fire department	*Acceptable location in the vicinity of the fire alarm annunciator - Sentence 3.2.8.9.(8)*	*Acceptable location in the vicinity of the fire alarm annunciator - Sentence 3.2.8.9.(8)*

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